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Starch Converting Enzymes Used in the Textile Industries

Various Uses—Characteristics of Diastases—Trade Names—Influence of Acidity and Alkalinity—Influence of Salts

By ROBERT P. WALTON

STARCH converting preparations are used in a number of ways by textile manufacturers. A practice more popular in Europe than in America is to use such products for "thinning" or modifying starch pastes preparatory to sizing warps. Some also are used to advantage in the production and solution of color pastes, and for the removal of starch paste from the back-cloth or blanket used in printing. Oxidizing agents have been used for such purposes; an oxidizing material termed "Aktivin" has been recently introduced and was described by the writer in the REPORTER (Vol. 16, p. 789, 1927).* Acids and certain salts have also found application.

For enzymes the more important use, however, is that of desizing. Quoting Wallerstein in the Starch Symposium volume previously mentioned, "Desizing is practiced for one or two basic reasons, i. e., to render cloth more receptive to subsequent processing, such as kier boiling, bleaching, dyeing, mercerizing, napping or printing, or to impart the proper hand, feel and draping qualities to the finished cloth. Desizing is consequently employed at different stages of manufacture in different plants, depending upon the nature of the work being carried out. Gauze and bandage goods are desized before bleaching so that a perfect white can be obtained and so that the goods on being steam sterilized will not turn yellow. Experience has shown that even the gauze goods contain relatively little size, a desizing treatment before bleaching makes for a permanent white.

"Another reason for desizing cloth before bleaching is to effect a saving in time and cost of chemicals in kier boiling and bleaching processes. Complete removal of sizing constituents permits of a shorter kier boiling period and saving in caustic soda.

"In order to nap goods satisfactorily, the individual yarns and fibers must be relatively free. Consequently, it is of utmost importance that gums and starches, etc., be removed first. Desizing of goods to be mercerized is essential if fullest luster and greatest economy of chemicals are desired. Dyeing of heavy gray goods is a practical impossibility unless the goods are desized either during or before the dyeing operation. In some cases, cloth is printed without being fully bleached. Thorough desizing of such goods is essential. Yarn dyed goods, such as blouse and shirtwaist goods, ginghams, whether of cotton, rayon or mixture of these yarns, can be properly softened only if desizing of the warps is effected. Scouring of such goods in hot alkaline or soap solutions does not effect complete removal of starch and not infrequently causes harshness and loss of luster if they contain rayon.

"Although many mills still pay too little attention to desizing, it is nevertheless one of the most important processes in the manufacture of cotton, rayon and mixed goods."

CHARACTERISTICS OF DIASTASES

Enzyme preparations are now used almost exclusively for desizing. They may be defined as biochemical catalysts and those used for desizing have practically no deleterious effect upon the fabric. In this latter respect they are to be preferred to chemical desizing agents.

Those enzymes which "liquefy" or "dissolve" starches, dextrins and starch gums are known as

*Cf. article by Feibelmann, Vol. 17, p. 435 (July 9, 1928).—Ed.

diastases. Although all starch-degrading enzymes are termed diastases, the characteristics of various diastases are spectacularly distinctive. Malt diastases, animal diastases, bacterial diastases and mold diastases are all used extensively in the industry under various trade names, and each has a specifically different degree of activity or stability. Points of distinction are: Influence of salts on activity, optimum acidity or alkalinity, fatal acidities or alkalinites, temperatures of optimum activity, and, finally, the inactivating or fatal temperatures. This latter temperature is that at which the diastase is "killed" or completely inactivated. It is a common occurrence in practice to have the diastase killed by raising the temperature of the bath too high. (The simplest chemical conception of this phenomenon is based on the assumption that enzymes are high molecular weight proteins which are hydrolyzed by the aqueous medium at high temperatures, the hydrolytic products being enzymically inactive.) Despite these points of difference, which are very marked, the assumption has often been made in practice that conditions suitable for one diastase will also be suitable for another. Now, an academic knowledge of enzyme chemistry is considered of no more value to a textile mill operator than, say, a grounding in astrology or paleontology. Nevertheless a general conception as to the factors involved in this desizing operation will be of considerable value in cutting down the costs of a fairly expensive operation. Such an insight is particularly valuable when the process of operation is variable. This operation is one of the least responsive when there is a necessity for speeding up production. Attempts to speed up desizing by increasing the temperature can have the opposite result and by increasing the diastase concentration some of this material, which is fairly valuable, may be wasted.

For the Symposium volume previously mentioned, representative manufacturers of these four types of diastases were invited to present a concise summary of the characteristics of their particular product, along with detailed directions as to their use in desizing. This was not intended exactly as a means of comparing relative desizing costs, but rather that the essentially different conditions of operation be emphasized. Some of the most qualitative conditions are given here.

Trade Names

In the case of malt diastases, Diamalt is taken as a representative market product, Degomma is taken as representative of the animal or specifically, the pancreatic diastases, Rapidase as representative of bacterial diastases and Polyzime as representative of mould or fungus diastases. Other trade names for diastase products are Diastafor, Diax, Diastin, Laundr-Aid, Fermasol, Clenbumol, Brimal, Farinol, Balmal, Biolase, Hydrolin, Maltine and Textase.

Temperature Effects

Gore states that the optimum temperature range for malt diastase is 122-145° F. and that the fatal temperature is about 177° F. Turley gives the optimum temperature of a pancreatic diastase as 104-122° F., and the fatal temperature as about 131° F. Wallerstein states that a particular bacterial diastase acts most rapidly at 158° F. Takamine places the optimum temperature for a particular mould or fungus diastase at 131° F. and the fatal temperature at 180° F.

Influence of Acidity and Alkalinity

For malt diastase the optimum acidity ranges from pH 4.0 to 5.0, according to the temperature and type of buffer salt used to regulate acidity. This corresponds to a weak acid solution. For pancreatic enzymes the optimum activity occurs at about the neutral point or pH 7. With bacterial enzymes, at temperatures below 150° F., the reaction is not a particularly important factor, as the enzyme is stated to be effective in both acid and alkaline solutions. For mould or fungus diastases the optimum pH is placed at 5.4, a weak acidity intermediate between neutrality and the optimum acidity for malt diastase.

Influence of Salts

The effect of salts in stabilizing and increasing the activity of diastases is most pronounced in the case of pancreatic diastase, there being an enormous increase in activity upon addition of certain salts. The salt effect is not as marked, but nevertheless an important factor in the case of malt diastases and mould diastases. It is of practically no significance in the case of bacterial diastases. Phosphates and sulphates increase the activity of mould diastases but, unlike malt, chlorides have little effect. In the case of those salts which have an activating effect, there is usually also a corresponding stabilizing effect. This is particularly important, as some preparations deteriorate rapidly on standing.

Such factors as the above are of importance in selecting the product to be used in variously regulated desizing processes. After having selected a preparation which is stable and active under the given conditions of desizing or storage, the prime factor then, of course, is relative cost per unit of activity. Finally, regarding this unit of activity, it is well to emphasize that it should be based on the "liquefying" or "dissolving" power of an enzyme rather than the sugar-forming capacity. Although related, these two processes are not the same, and it is only the first which is effective in the desizing operation.

The Naugatuck Mills, Inc., recently incorporated, have purchased the Dunham Mills, Naugatuck Conn., and will manufacture cotton and fibrous materials.

Textile Research*

Meaning of Fundamental Research—Troubles Begin After Laboratory Work—Lack of Criticism of Research Reports—Faith in Research Blind—Encouragement of Research

By J. H. LESTER, M.Sc., F.I.C., F.T.I.

IT is eleven years since I read a paper before the Textile Institute on this subject, and I refer to it because I should find it difficult to define research more clearly than I did then, or to advocate its claims upon the industry with greater force or justification. May I then, at the outset, suggest that this paper be regarded as supplementary to the first? To-day we can look back upon a few years of experience in the prosecution of research by the several research associations which have been established, and it is not too early to attempt a broad view of the present position, for, as Abraham Lincoln said, "If we could first know where we are, and whither we are going, we could better judge what to do, and how to do it."

In looking backward we cannot deny that the industry and the Government have responded to the call for financial support, but I am not sure that we do not owe an even greater debt to those few prominent leaders of our industry who launched their appeals during the critical period of the war. We see, too, if we examine the matter more closely, that the control of research has by no means been confined to the leaders in pure science on the one hand, or to the representatives of purely industrial interests on the other. Nor can it be denied, I think, that we have seen some changes in the policy of the associations, the tendency being to steer a middle course between theory and practice, between science for its own sake, at the one extreme, and the obtaining of results of immediate commercial value at the other.

The advantage of fundamental, or deep-digging, research has often—and rightly—been insisted upon, particularly by the most learned and experience scientific research workers. But it is worth while to consider what we mean by fundamental research. And it will be well to use the phrase always as a relative one, and not as though it had an absolute meaning. If we use it in the absolute sense, it can only be taken to refer to the subatomic state and to the actual origin of all movement and change of matter or of electrical condition. Even the most ardent advocates of "deep-digging" research will hesitate to advocate the advancement of our textile industry by going to this extreme. In the encouragement of fundamental research it will be well to consider that it may apply to very ordinary operations in industry and in everyday life, with just as much and perhaps more prospect of immediate results of commercial value, than an attempt to relate those operations to the basic atomic and electrical conditions. If we consider research into the operations of a loom, we shall find that research, invention, and improvement may be effected by considering those fundamental elements of cost, lightness, simplicity, construction and speed, which would go to make better looms. Only by careful inquiry—call it research if you like—can we be sure whether a loom *costing* £12 is really cheaper than a much better made article *costing* £90. Similar research is necessary to show whether it is worth while to adopt a *lighter* construction in the moving parts as a means of power reduction. True *simplicity* of control of the warp and cloth beams may justify a good deal of mechanical complication, in the way of positive and controlled let-off and take-up, and I doubt whether any problem of the weaving shed cries out for research more than this. Is the *construction* of the loom as an assembly of mainly iron castings the best that can be devised, or is it time that pressed steelwork be employed, as it is so largely nowadays in almost all forms of engineering? Am I far from the truth if I say that the success of the Ford car was more due to this form of construction than to any other circumstance? We shall encourage research, and advance our industry if we recognize the fact that just as true research work may be done by a loom tackler in simplifying a loom as is done by conducting an inquiry into the plasticity, elasticity, or structure of cotton or other fibers. Eventually, no doubt, the loom will be made mainly from pressed steel, and will be consequently lighter, stronger, cheaper, and more accurate; and probably it will have a longer useful life. But so far as our weaving industry is concerned, it must surely be agreed that the loom remains one of the most antiquated pieces of machinery still in use. Mere invention has done its best, or its worst, to patch up this frightful rattletrap, and research is needed to make it into a useful servant instead of what it is to-day—a very hard master.

Troubles Begin After Laboratory Work

There are some few of us who have conducted what is commonly recognized as laboratory research, and have found out in the laboratory some new means, let us say, of producing marketable things. We have then had to leave our laboratories, and to try the thing out in the plant after designing new machines, inventing makeshifts, and trying to provide for all contingencies. We have found ourselves launched on a perilous sea. Our real troubles and difficulties are just begun, and there is not one of us who fails to look back to the serenity of

*Delivered before the Yorkshire Section of the British Textile Institute and published in its Journal

our work in the "Lab," with feelings of regret that it is over. We smile at the thought of the fundamental work being the most important part of the long series of disappointments and few successes that have been our lot. It was our beginning, certainly, and was fundamental in that sense, but having regard to the purely industrial end and object of the work, the prime importance of fundamentality takes on very small dimensions. We cannot but reflect that though we were very proud of the brilliance and originality of our work in the laboratory, there were a dozen or more objectives that would have yielded the same commercial values, given the same time, expenditure, and energy on the works, but without similar fundamental research. An illustration may be given to make my meaning clearer. Fundamental research may have shown that a mercerized effect may be hastened, improved and cheapened by introducing a new group to the soda-cellulose molecule, and this may have been worked out as a successful and very valuable process. On the other hand, many processes could be developed in the works which depend far less, if at all, on laboratory research of the same nature. An example may be cited in the Beninger machine, which is essentially nothing more than the substitution of expanding rollers for stenter clips. The machine is now widely used, and has effected, for certain purposes, great improvements and increased production in many works. Again, it is quite possible to develop a series of processes in mercerizing wherein the material, whether yarn or cloth, could be maintained under the necessary tension throughout the whole scouring, bleaching, washing, and perhaps dyeing processes, with, in some cases, the certainty of great economy. Nothing but patient experimenting with well-skilled control and the necessary capital will be required to achieve success, and the chances of such success are at least as great as in the case of applying a fundamental discovery to practice. It is experiences of this kind—though the above cases are purely hypothetical—that lead the conductor of industrial research to regard as a whole, and not as possessing a single germ of fundamentality whose absence would ruin the structure.

Even commercial success itself may not be the end and object of all research. The end and object of much research is education—often with commercial success as a very remote object indeed, for it may be to educate the worker in a hundred methods, only one of which will be utilized, or it may be but one of the means of educating the industry as a whole. To achieve its ends—whatever they may be—a proper balance or sense of proportion must be observed between many factors—fundamentality; thorough knowledge of one or more of the sciences involved; some acquaintance with the collateral sciences; knowledge of the art and processes of the industry; commercial considerations involving time, expenditure, and the value of the end result; co-operation with scientists and industrialists; publication; and the study of competitive progress. All of these are important, but no single one is really the essential to the prosecution of industrial research. A sane and balanced view of the subject refuses to pick out one factor or to tie itself to a mere phrase as though it expressed, or was essential to, the whole.

Lack of Criticism of Reports

It may be said without question that far more industrial research work is done than is ever published. The reputation of any research department, whether it be private, semi-private, or co-operative, must depend upon either the industrial (commercial) results obtained, or upon the publication of the research. When only limited policy is given, as, for example, when it is only the members of a research association who receive the reports, there appears to be a very serious danger of these reports not having that useful and necessary criticism which broadcast publication is subjected to. Criticism of this kind may come from the scientist, but more frequently it comes from the industrial end, though in either case it is extremely difficult to induce the critic to direct his comments usefully, or to allow such comments—however valuable they may be—to receive anything like the same publicity as the original. Perhaps the most useful assistance that the industry can render in applying science to textile manufacture is in the direction of discussing the results of research with its originators, and although by means of "lectures" opportunity is often given for such discussion, it can scarcely be said that the atmosphere of the lecture hall is conducive to giving anything like that kind of constructive and useful criticism which discussion on the same level ought to give. Those who represent the industry and who are capable of taking part in such discussions are, of course, much to blame for not using as they should the opportunity offered by such lectures for discussion, but what shall we say of the research worker who is offered a platform to speak from and who either refuses it or uses it merely as a means of recitation, failing to organize and conduct the discussion which ought always to bring the richest reward to both the lecturer and his audience?

Research has failed just in so far as it has been misunderstood. A land flowing with milk and honey was promised by many foolish scientific people who thought that the application of science to textile manufacture only began during the war, and that this untilled field contained bars of solid gold just below the surface. The result has naturally been disappointing to the misguided minds of textile manufacturers, who could scarcely be expected to discount the hopes of those who expected a few years' work to show many triumphs at least as valuable to industry as Horace Lowe's process for mercerising cotton, or as the production of synthetic Indigo. Commercially valuable results *have*, however, been obtained, but they have been obtained by the slow and certain method of searching for fundamental truth and not as the result of chance discovery or invention. I shall not attempt to show the value of the results so far obtained.

or even to enumerate any of them. The results are published, or at any rate a large proportion are, and those who know them best can and do value them most highly. But I must say a very few words to the many who, from choice or circumstance, have had to confine their interests to the art and processes of the industry, and who, for better or worse, are not fluent in the language of science—those who don't like such phrases as "morphological inhomogeneity." To those of them who are engineers, I would say, "Can you read with pleasure the scientific books dealing with mathematical calculations necessary for calculating the stresses on complicated girder structures? Do you not rather trust your lives to the engineers who built the bridges they have constructed?" To the man who is sick, "What is it to you whether some of your membranous structures are permeated with imperfectly oxidized aggregations, as long as your doctor tells you that a trip to Blackpool will put you right?" In short, the details of any specialist's research work are seldom easy to understand. Far more credit is due to the man who can make his work interesting to the general public than is commonly supposed. The work of what I may call "translation" is still in its infancy, but anyone who will read the B. C. I. R. A. Five Years' Report will see that it has at least commenced—and in earnest—for this is a most readable and interesting volume.

Faith in Research Blind

Industry has unbounded faith in advertising. The expenditure of £10,000 per annum as a means of selling a new or even an established product is a common occurrence. It is regarded as an investment, that is to say, something bound to bring back something more than is spent. Research is less certain of results. The quality and quantity of research are difficult to control, and with the best of organizations there may be no commercial fruition, or the results may be so long in coming that the patience of the investor—or, should we say, speculator—is exhausted. In the main the faith of industry in research is a somewhat blind faith. It is akin to faith in the goodness of being good, to faith in to-morrow being a fine day, and to the faith of many people in quack doctors. There is something occult about it, because in the main it is impossible for the average merchant or manufacturer to understand its operations. To such a person research is not the result of ordinary painstaking operations, like draughtsmanship or buying and selling, but it is something requiring glittering glass things, and polished brass combined with and made to work under the operations of a peculiar genius. It is the danger of this blindness in the faith of the industry which constitutes a real menace to research, and which prevents most merchants and manufacturers from embarking on so perilous a sea. The worldly-wiser men are content to view the operations from the shore, and to cheer the mariners with words of praise and sometimes with promises of money. The gifts of money are too often limited to the sums usually paid for pew rents, telephone charges or Christmas boxes. The promises, of course, are large—so large, indeed, as to be indefinite—and so indefinite that if a barge load of gold appears in the offing, the rates charged for landing the cargo increase a hundredfold and the pilot must be paid the fees he would get for the salvage of a wreck!

The more the industry sees of research, the more that research comes to earth as a piece of very ordinary work requiring the same relentless energy, the same expenditure of time and money that any new thing or venture requires. There is danger in the misunderstanding of research because the industry expects it to provide rather easy ways of making money quickly. It is likely enough that here and there the results of one fortunate piece of research will provide a fairly rapid means of making much profit for one firm—generally for a limited period; but however fortunate a large number of researches may be, the industry as a whole will benefit but little if those results are entrusted to the industry as we find it to-day. In other words, research may benefit the industry but little, unless a very different state of organization of industry can be developed. It must be said that the firms we commonly regard as progressive, who are constantly adding to and improving their products, constantly studying the product of their competitors, and availing themselves of current literature, of economics, and of technical education in their latest forms, will benefit by research, but the number of such firms or groups is but few, and they by no means represent the industry as a whole. In the larger groups there is so little decentralization that the individual expert is discouraged, suppressed and limited in his activities, or even when departmental managers are given a full share of responsibility, those managers entrench themselves behind barriers against their equals and even against their assistants. Indeed, the very essentials of co-operation are excluded, with the result that although the one-man show is abolished, it merely becomes a multiplicity of one-man shows. The management which does not insist upon full and free intercourse, and instruction of all subordinates in departmental interests, inevitably reaps its reward, and research can be of no use to it.

Encouragement of Research

Now that co-operative research has been organized for all the most important branches of the textile industry, the question naturally arises as to whether research conducted by individual firms is, or will be, encouraged or discouraged, whether the liaison between the separate research associations is, or will be, constructive and beneficial to each and to all, and again as to whether there will be quite the same stimulus to independent research that there was ten years ago. Ten years ago there was an almost open field for textile research, with but a few prospectors here and there digging holes in the ground, but to-day the whole field has been staked out, not exactly as mining "claims," but certainly as spheres of influence.

Let us hope that the constructions of roadways by the associations will be of assistance to the universities and to individual research, and that the publicity so far given to the work of exploration by the associations may encourage the student, the lone gold seeker, and the progressive manufacturer to search for and to find that particular treasure he needs. It will, indeed, be a thousand pities if these research workers get the idea that research necessitates a thoroughly equipped laboratory. Closely bound up with this question of encouragement and development of research workers, for in a general way it may be said that progress in research must be dependent upon the number of workers engaged therein, and it would be disastrous to the industry if the scientific organization of research through the associations should diminish or limit the number of chemists and physicists employed by manufacturers. If there be a common weakness in our research organizations to-day it lies in the relatively small proportion of the staffs who are well versed in the actual processes and art of textile production, and this intimate link between science and industry is being for the present maintained by the trained scientist *in the works*. Already a mass of published matter is being produced by the research associations, but will anyone claim that it is being effectively used by the industry? Here and there it is carefully read, digested and appreciated, but until the spinners, manufacturers, bleachers, dyers and printers employ and make use of more men who can appreciate those publications and apply them in many more works throughout the textile industry, the efforts of the associations must be in a sense wasted. The real need to-day is, I say deliberately, more for chemists and physicists in the works than for more research associations or for larger staffs. I do not mean that the staffs in question are sufficient for the needs of the industry, for they are not. It is because I have unbounded faith in truly co-operative research, whether in the research association or in the works, as the only possible means of maintaining our present position in the world's markets, that I am addressing you to-day. But we must look upon it as a very serious business, and it must be organized on commonsense business lines. More money will have to be spent upon it; more confidence still will have to be given to the tried leaders of research; more well-directed criticisms will have to be given to the economic production of research work. With this encouragement and help, there remains no reason why the advancement in textile manufacture of our country should not continue, and insure that supremacy in export which we may fear we are losing.

The addition of another story to the sheet and pillow case department of the Lewiston Bleachery & Dye Works, at Lewiston, Me., is being considered by the Pepperell Company. The continued demand for Pepperell white goods, and the growing demand for the colored sheetings and pillow cases has made expansion necessary, it is stated.

FOREIGN DYES IMPORTED DURING JUNE

Slight Increase Over May—Germany Still Controls Major Percentage

IMPORTS of synthetic dyes through the Port of New York and other ports during June totaled 411,662 pounds, with an invoice value of $309,607. Imports by ports were as follows: New York, 395,439 pounds, valued at $291,922; Albany, 9,098 pounds, valued at $8,709; Boston, 7,125 pounds, valued at $8,976. Comparative figures and other data follow:

	1928	
	Pounds	Invoice Value
January	415,156	$327,148
February	478,407	391,351
March	378,191	316,183
April	633,815	505,152
May	382,233	295,969
June	411,662	309,607
Total six months	2,699,464	$2,145,410

	1927	
	Pounds	Invoice Value
January	196,620	$186,387
February	312,277	262,364
March	404,714	352,414
April	402,783	323,732
May	349,476	265,752
June	318,450	253,054
Total six months	1,984,320	$1,643,703

Per Cent of Dyes by Country of Shipment

	June, 1928	June, 1927	Jan.-June, 1928	Jan.-June, 1927
Germany	63.40	68.00	64.21	56.20
Switzerland	25.90	17.00	23.98	25.94
France	1.20	4.50	1.71	3.37
England	3.00	1.00	2.26	4.52
Belgium	2.50	5.00	2.96	5.43
Canada	2.00	1.50	2.29	2.54
Italy	1.40	3.00	1.93	1.88
Netherlands	0.60	...	0.66	0.12

Leading Dyes, by Quantity, Imported During June

	Pounds
Rhodamine 6GDN, 6GH (single strength)	18,425
Hansa Yellow G (single strength)	16,980
Vat Brown G (single strength)	16,000
Anthra Yellow GC (single strength)	11,445
Cibanone Orange R (single strength)	11,242

Remaining in Bonded Customs Warehouse

	Pounds	
	Dyes and Colors	Intermediates
January 31, 1928	609,573	818,695
February 29, 1928	636,566	1,291,636
March 31, 1928	716,032	1,264,965
April 30, 1928	740,239	506,337

Finishing of Rayon and Rayon Mixtures*

Sizing and Delustering

ONE of the principal things that confronts the finisher of to-day is the proper handling of rayon yarns and piece goods, either all-rayon, or rayon mixtures.

The treatment of cotton and silk materials has gradually been evolved through many years of progress and study, so that most of the problems attending the finishing of this type of goods have become well understood and reduced to standard practice.

When the cotton and silk finisher steps from these well-known fields into the relatively new realm of rayon and the other artificial silks, he immediately finds very little past experimentation to guide him, and is largely dependent upon what information is available, very little of which has as yet been reduced to exact practice.

This field, like most others, is not without its contradictory observations and theories, and the purpose of this paper and those to follow is to set down in tangible form the most approved methods now in vogue in handling rayon and like materials for the assistance of those in the textile branches who are called upon to handle these comparatively new materials.

Sizing of Rayon

Inasmuch as the success of the subsequent finishing operations depends to a large extent upon the removal of sizing materials from rayon piece goods, it is well to understand what materials are used in the sizing process and the methods employed (1).

There are two general methods of sizing rayon (2):

a. Skein Sizing,
b. Warp Sizing.

a. *Skein Sizing* is practiced to some extent, but unless handled carefully, is apt to give trouble because of skein entanglements and uneven tensions in weaving, due to uneven sizing. Skein sizing is also more costly than warp sizing chiefly because it involves a loss in production during the winding operation.

Formula for Skein Sizing

60 pounds Gelatin,
198 gallons Water.

Soften the gelatin by allowing it to stand for a few hours, then boil for from 15 to 20 minutes, allowing the bath to cool until it is lukewarm before entering the rayon. Dip the yarn in the bath, then hydroextract for from 15 to 20 minutes. The yarn is then ready for the drying machine, but should be shaken out before drying, to prevent the threads from sticking together.

The above formula is preferably used for yarn having additional twist; that is, four turns extra to the inch.

Formula (2) set forth below under the paragraph devoted to warp sizing can also be used successfully for skein sizing by omitting the glycerine.

b. *Warp Sizing.* The greater amount of rayon which is being used for warps is sized directly in the warp on several of the standard slashers. Both the Johnson and the single and double drum Saco Lowell machines are being used successfully. Several articles have recently appeared in the trade journals which give considerable detail on this subject (3), (4).

Types of Sizing Materials Used

Rayon is generally sized with glues, gums, dextrins and starch. In many instances there is also added some fatty matter to render the warp more pliable.

Formulas for Warp Sizing

For machine sizing, the following formulas are those most suitable for rayon:

(1) 3½ pounds Flexible Starch,
1½ pounds Cornstarch.
1/10th oz. (3 grams) Powdered Diastase

This mixture is dissolved in 3 gallons of water after which it is poured into a tank that contains 15 gallons of water. The contents are then boiled and stirred for from 15 to 20 minutes.

Before using this preparation, it should be allowed to cool down to a temperature of 80° to 90° F., and this temperature maintained during the process of sizing.

(2) 11 gallons of Water,
5 pounds Gelatose,
3 ounces Glycerine.

Boil the mixture until scum disappears, which will require about 25 or 20 minutes. To preserve this preparation, add 4 ounces of benzoate of soda to 10 gallons of solution.

This preparation can be used cold during the process of sizing.

Delustering

Rayon in its natural state has a very high luster, and in order more closely to simulate the appearance of silk, it becomes desirable to deluster it.

Most of the processes for delustering rayon are patented. These usually involve the precipitation of an insoluble opaque salt on the fiber.

The delustering operation can be carried out, either (1) while the rayon yarn is forming, which is the most

*From a bulletin prepared by Takamine Laboratory, Inc.

(1) Some Hints and Some Don'ts About Sizing, R. P. Morningstar, The Rayon Journal (1927), No. 6, page 27.

(2) Rayon and Its Treatment, IV, Warp Sizing and Skein Sizing, R. W. Taylor, The Rayon Journal (1927), No. 12, page 13.

(3) Machine Sizing of Rayon, R. P. Morningstar, The Rayon Journal (1927), No. 3, 2, page 33.

(4) The Sizing of Rayon Yarns, J. H. Shinn, Silk (N. Y.), June, 1927, page 51, 20.

approved practice; or (2) subsequently, in the skein or piece.

(1) Those which deluster the rayon yarn while it is forming may be listed as follows:

(a) The incorporation of a special petroleum jelly in the viscose spinning solution;

(b) The use of materials in the spinning bath or solution to deposit free sulphur on the fibers.

(2) Those methods of delustering rayon after the thread has been formed consist mainly in adding weighting materials. These may be classified as follows:

(a) Barium sulphate weighting, which is produced by the interaction of Barium Chloride and Hydro Sulphuric Acid on the fibers.

(b) Aluminum Acetate weighting or Aluminum Soaps weighting.

(c) Tin Phosphate Silicate weighting.

Delustering after the yarn has been spun and finished in skein form is not usually commercially successful nor recommended. However, in those cases where it becomes necessary, the skein is treated with a barium chloride solution of about 2%, and then dipped in sodium sulphate or a very weak sulphuric acid solution in order to precipitate the barium sulphate upon the fiber. This is then washed until as much of the adherent barium sulphate is removed as possible, and the yarn will have acted as a filter and retained a considerable portion thereof, thereby imparting the desired dulness.

The main difficulty with the above treatment is that after subsequent repeated washing, the yarn again lusters up.

The same method is sometimes used in delustering hosiery, using the barium chloride solution at a 5% concentration, and then passing it through a 5% sodium sulphate solution and rinsing.

These operations are carried out at moderate temperatures and for varying lengths of time according to the amount of weighting and the degree of delustering desired. They are, however, not to be recommended if they can be avoided, as there is always a tendency to weaken the thread and the delustering is not entirely permanent.

WINNERS OF H. A. METZ TEXTILE AWARDS

Each year those students of Textile High School, New York, most proficient in certain phases of work intimately connected with the science of textile production are awarded prizes donated by the Hon. Herman A. Metz.

The Metz awards for 1928 have been received by William Rothman, first, and Richard Glassman, second, in Chemistry and Dyeing. The first prize in Batik and Dyeing was won by Edward Faunig; second prize by Beatrice Shutard.

An Old-Time Bleachery

[EDITOR'S NOTE.—*The following article, published nearly ninety years ago, may prove of interest to some of the readers of the* AMERICAN DYESTUFF REPORTER, *particularly to those who had experience in the early years of the industry. It is not published in any way as representative of modern practice, but is purely of a historical nature.*]

THE following account of the Crescent & Adelphi Works, Salford, England, a new bleachery, was given by Bradshaw's Manchester Journal, August 14, 1841:

Instead of the extensive fields and numberless low buildings occupying acres of land which characterized similar establishments in the olden time, the whole process of bleaching, starching and finishing is conducted almost entirely within the premises.

In a low adjacent building the goods to be bleached are subjected to the first process, that of boiling or steaming in an alkaline lye, by which the dirt or coloring matter is loosened and partially separated from them. A number of immense caldrons are ranged round the place, each of which is furnished with an iron grating fixed a few inches above the bottom of the boiler; to this an iron pipe is attached with a raised concave top. The pieces of cloth, first tied up in bundles of a dozen each, are placed upon the grating in regular layers to the top of the vessel. A quantity of lye is then poured upon the whole, and this, by means of steam introduced below, is soon heated to the boiling point, and rising through the center pipe is again distributed over the surface by means of the concave top, until by continued circulation the whole mass is thoroughly penetrated.

The cloth, or yarn, is then conveyed to large cylindrical barrels, technically styled dash wheels, hung upon their axes, and turned by steam power.

The interior of these machines is divided into four compartments by rails, into which the goods are introduced through circular apertures in front, while behind a pipe is inserted by which a constant stream of water is thrown in, and the machine being set in motion the goods are dashed from side to side until by that means they are thoroughly cleansed from any remaining extraneous matter.

LIME AND SULPHURIC

From the dash wheel the goods are removed to cisterns, fitted up so as to admit of diluted chloride of lime being circulated through every part of the vessel by means of pumps worked also by steam power. From whence they are removed to other cisterns where highly diluted sulphuric acid is applied to them, the dash wheel being used between each process, and the goods being freed from the water by passing through rollers constructed for that purpose. When by this means the

(*Continued on page* 489)

Proceedings of the American Association of Textile Chemists and Colorists

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SPRING MEETING OF THE PIEDMONT SECTION

THE spring meeting of the Piedmont Section of the American Association of Textile Chemists and Colorists was held at the Poinsett Hotel, Greenville, S. C., April 14. Eighty members of the section were present at the banquet, and ninety members at the meeting.

The following papers were presented:

Dr. E. W. Pierce, of the Ciba Company, presented a paper on "Color."

Prof. Charles E. Mullin of Clemson College, Clemson College, S. C., presented a paper on "Some Possible Applications of pH Control in the Cotton Industry."

F. H. McCoy, of Lowell Manufacturing Company, Stanley, N. C., presented a paper on "Beam Dyeing."

E. L. Fletcher, of the Burkart-Schier Chemical Company, presented a paper on "Sulphonation of Textile Oils."

Mr. Fletcher's paper, due to his absence, was read by E. J. Kelly, his assistant.

A report was submitted by the Membership Committee, and forty eligible men will be approached in an effort to obtain them as new members. It was decided that the July meeting will be held in Asheville, N. C.

A technical committee was appointed, and members wishing information are requested to communicate with Dyer S. Moss, Greenville, S. C., secretary of the Piedmont Section.

R. W. Arrington tendered his resignation as vice-chairman of the Section.

DYER S. MOSS, *Secretary.*

Some Possible Applications of pH Control in the Cotton Industry*

By CHARLES E. MULLIN

Professor of Textile Chemistry and Dyeing, Clemson College, S. C.

MR. CHAIRMAN and Gentlemen: My subject tonight is such a large and interesting one that I have no hope of being able to cover it completely in the time available this evening, so that I will just

*Paper presented at the spring meeting of the Piedmont Section of the American Association of Textile Chemists and Colorists, held at Greenville, S. C.

briefly outline the methods whereby the pH of solutions may be determined and mention a few of the many possible applications in the cotton industry. After I am through I hope that some of you will ask the questions necessary to bring out the many interesting points in connection with the practical applications of pH control in the mill.

Don't be afraid to ask the questions as it is in the discussion that the real interest in any talk usually develops. Perhaps there are some men here to-night who, through lack of interest in the subject, do not even know the meaning of the term pH, and that reminds me of a good true story. All good after-dinner speakers start off with a bunch of good stories, so here is where I shall try to qualify with one about something that really occurred to a friend of mine, a medical doctor connected with the University of Pennsylvania.

You know that pH has its place in biology and medicine, just as in the industries. A lady in Boston had been sick for some time, and as the local physicians seemed to be unable to give her any relief her doctor sent her to the University Hospital in Philadelphia for observation, etc. While she was there my medical friend made a complete examination, including blood tests, etc., and one of these included a pH determination of her blood. Well, eventually the lady was cured and returned to Boston. I don't know whether pH did it or not, but anyhow the lady had been sick so long that she had gotten pretty well acquainted with most medical terms, but the pH was a new one to her and when she got back to Boston she immediately asked her physician what the Philadelphia specialist meant by the pH of her blood. I guess the Boston physician was in the same class as some other men; after stalling long enough to think up an answer, he told her that the pH of her blood meant the "past history" of her blood. The lady did not have much more to say but appeared to be somewhat perturbed, and the same evening wrote my friend in Philadelphia to find out just how much of her past history he could tell from her blood. Evidently this lady had some pH or past history of which she was not very proud.

Well, Gentlemen, pH does not mean past history in the case of textiles; it has in many cases more to do with the *future* history of the goods, the quality, cost, wearing properties, etc.

Well, pH is simply an abbreviated term for the longer phrase, hydrogen ion concentration, which is in turn merely a method of expressing the degree of chemical activity of a solution. I am going to explain the meaning of the degree of chemical activity.

Defining Chemical Activity

You are all familiar with the difference between temperature and heat. Here we have a graduate containing 1,000 c.c. of water at a temperature of, say, 10° C. Here we have a smaller graduate containing 100 c.c. of water at a temperature of 100° C. Both contain the same number of heat units above zero Centigrade, yet the degree of activity of the heat in each is quite different. You know, for example, that this water at 100° C. will cook an egg in a very few minutes, while this larger volume of water at 10° C., but containing the same amount of heat, will not cook the egg. Yet both waters will melt the same amount of ice. The difference is in the *degree* of heat activity.

In the same way we have degrees of chemical activity. You all know that of two solutions, the one containing a certain amount of caustic soda and the other the same or an equivalent weight of sodium carbonate, the one with the caustic is much more active than the one containing the carbonate. This is due to the difference in the hydrogen ion concentration of the two solutions and is usually expressed as pH.

In the same way, we can have two acid solutions, one a normal acetic acid solution containing about 60 grams of actual acid per liter, and the other a normal hydrochloric acid solution containing only about 36.5 grams per liter. In other words only about half as much acid, but we all know that in degree of chemical activity the normal hydrochloric acid solution is far stronger than the acetic solution.

Now, the degree of chemical activity or pH of a solution depends upon the degree of dissociation of its components, and in the case of the above acids, the normal hydrochloric acid is dissociated to almost 80%, while the acetic acid is only 0.37½ dissociated. The result is that the normal hydrochloric solution is about 200 times as strong as the really more concentrated acetic acid solution. This difference in the degree of chemical activity is expressed as pH 0.10 for the hydrochloric acid and pH 2.43 for the acetic acid.

Probably some of you may be interested in the meaning of the phrase "degree of dissociation" mentioned above. You are all familiar with the meaning of the old term "hydrolysis." Well, dissociation is just hydrolysis carried a step farther. In other words, we used to say that in an aqueous solution soap partially hydrolyzes to caustic soda and free fatty acid.

According to the dissociation theory of Arrhenius, this caustic soda and free fatty acid is further split up or dissociated into sodium and hydroxyl ions, and hydrogen and hydrocarbon-COO ions, respectively. The result is

that as sodium hydroxide is a "strong" base—that is, dissociated to a high degree; while the weak fatty acid is not highly dissociated, and we have an alkaline solution resulting.

The degree of chemical activity of any solution is entirely controlled by the presence of the above-mentioned ions. Where there is an excess of hydrogen ions over the hydroxyl ions, the solution is said to be acid, and with increasing concentration of hydrogen ions the pH decreases from the theoretical neutral point, pH 7, to zero, or even a minus pH.

On the other hand, as the concentration of hydroxyl ions increases over that of the hydrogen ions, the degree of alkaline activity increases and the pH increases from pH 7 to pH 14, or even above this point. The pH is merely the logarithm of the reciprocal of the hydrogen ion concentration.

And now, if you understand that, we will take up the measurement of the degree of chemical activity of a solution, or its pH.

There are two common methods in use for determining the pH of a solution. These are known as the potentiometric and colorimetric methods. In other words, the one is by measuring the voltage or potential on an arrangement of electrical equipment, while the other is by means of indicators and color standards. Each of these methods has its limitations and advantages.

In the colorimetric method we merely add an accurate volume of an indicator solution of definite strength to a fixed volume of sample and, by means of certain apparatus, such as that on the table, compare the color of the sample with that of a standard solution of known pH in a separate vessel. It is really very simple, and not nearly as difficult to operate as the average radio set.

In the potentiometric method, the sample merely acts as the electrolyte or solution in the battery. You are all familiar with the old-style "wet" batteries. Some used electrodes of copper and zinc; others used carbon and zinc, etc. The voltage obtained from the battery depended upon the chemical activity of the electrolyte. In the potentiometric determination of pH or chemical activity we merely measure the voltage obtained between two conveniently arranged electrodes placed in the sample. The sample acts as the electrolyte, and the greater the chemical activity of the sample the greater the difference in pressure, voltage, or potential, between the two electrodes. While circumstances alter cases, this is the general principle upon which all potentiometric pH determinations are made.

Applying pH Control to Cotton Manufacture

As you all know, many excellent papers upon the various methods of pH determination have appeared in the literature recently, some of them in our own journal. Therefore, I am not going into further detail in this matter, but will be glad to explain and demonstrate both methods after the meeting to anyone interested. And now for the application of these determinations in the plant.

The subject of my paper is "Some Possible Applications of pH Control in the Cotton Industry," and I want to say that the relation of pH to the cotton industry starts farther back than the textile industry. It starts with the agricultural end, the growing of the cotton. The last thing we used this apparatus for before bringing it over here was to study the pH of some soils, and this is one of the first important contacts between the cotton industry and pH. Unless the pH of the soil is correct, the yield of cotton will not be what it should. But the importance of this factor certainly does not stop here; it enters into almost every wet process of the whole textile industry, not only the cotton industry but also wool, silk and rayon, as well as most of the related industries. In fact, there is so much to say on this subject that I am writing a book on "pH Control in the Textile Industry."

As it is impossible to go into details regarding each and every possible application of pH control in the textile industry, I will merely go over them briefly, and then if you are interested in any one or more of them you can ask for more details.

Probably the most logical place to start is with the preparation and application of size to the warps, as this is frequently one of the first wet processes. There are numerous methods of altering the starch before application to the warp, and in every case where a reagent is used, such as caustic, acid, enzymes, etc., the pH, time and temperature of the preparatory solution absolutely control the results. Queer as it may seem, too, the pH of the size in the box also governs the amount adhering to the warp or goods to a considerable extent.

Desizing and Kier Boiling Control

In desizing, either by means of acid or enzymes, the pH factor again becomes of the utmost importance, in that every enzyme product has an optimum pH range for the liquefication of starch and outside of this range the activity or efficiency of the product drops off very rapidly.

Kier boiling is another possible application of pH control. In some cases the pH here will be pretty high. Almost nothing has appeared upon the subject in the literature. It is very possible that both the efficiency of the scour and the formation of oxycellulose may be very largely controlled by the pH of the liquor. Where colored-effect goods are being handled, it may be particularly desirable to control the pH in order to eliminate or reduce fading and marking off.

In the chemick bath it is well known that the speed of

bleaching is largely controlled by the degree of acidity or alkalinity of the bath; in other words, the pH. Even such fast colors as Turkey Red fade rapidly in the hypochlorite bleach if the pH gets out of bounds. The production of oxycellulose is also controlled to a very large extent in the same way.

In peroxide bleaching, many papers in the last few years have pointed out the importance of pH control in obtaining the best, quickest and most economical results.

In mercerizing, while the pH may be outside of the usual range—that is, above pH 14—it is undoubtedly one of the important factors where uniformity and quality of work are desired.

While the dyeing of cotton is not usually considered to be a chemical reaction, there is still considerable discussion upon the point, and it has not been definitely proven that it is *not* a chemical reaction. However, both the fiber and the dyestuff are largely in the colloidal state in the dye bath, and the affinity of colloids for each other is largely governed by the charge upon each. This charge is controlled, all other factors remaining constant, by the pH of the bath. Therefore, whether the dyeing of cotton is a chemical or colloidal reaction, pH is one of the important controlling factors.

In the application of the vat dyes, pH control is particularly desirable, but as yet no very satisfactory method whereby it can be handled has been developed. In fact, this also applies to many other industrial processes.

There are almost innumerable other applications of pH control in the cotton industry, including scouring, souring, aging, antichloring, aftertreatment of colors, printing, finishing, and even laundering, etc.

Is It Practical?

You will hear many mill men say that pH control is not "practical." It is just as practical as you are capable of making it. It has been made practical in the leather, sugar, water and many other industries. It may not be practical in your mill for one or more of several reasons, such as: (1) That you do not operate any wet processes; (2) that on the particular kind of work you are doing there is no particular need for close control as to quality and costs; (3) that as yet no apparatus has been developed suitable for use in connection with your special work or problems; or (4) that you do not have the ability to apply the method in a practical manner. Be very careful to investigate this matter thoroughly so as to be sure that the last one above—(4)—is not the real case of impracticability in your case.

In fairness to the mill men, however, it must be pointed out that all of this work is in its infancy. It has innumerable applications, but most of these have not been worked out in detail. Much remains to be done in connection with methods and apparatus best suited for use in the mill. Undoubtedly great progress along this line will be made within the next few years, and the matter of making the process practical for every mill will be greatly facilitated.

In practically every wet operation where the best, quickest, most economical and uniform results are necessary or desired, pH control is just about as essential as the control of temperature of time. It will find many applications in all branches of the cotton industry in the near future.

After this address, a recess was called in order to permit the audience to inspect the La Motte and Hellige colorimetric and Leeds and Northrup potentiometric equipment on exhibit. H. E. Johnson, Sr., and Ross M. Stribling, Jr., of the Textile School, Clemson College, were present to explain and demonstrate the apparatus and its use. Considerable discussion developed in various groups regarding the methods whereby pH control could be used in the application of the vat dyes, hypochlorite and peroxide bleaching, kier boiling, the dyeing of union plush goods, size preparation and application, etc.

Color*

By E. W. Pierce
Ciba Company, Inc.

COLOR is one of the most important properties of matter; it is, in fact, the one property on which we depend for our knowledge of the world about us. The form of objects is only distinguishable to our eyes by the contrast existing on different parts of their surface and with their backgrounds.

A color is not a constant thing at any time, but is dependent on the amount of light it receives, as well as the manner it reflects that light back to our eyes. Let us take a perfect red billiard ball as an example: the casual observer would say it is a red ball, a more critical colorist might add that the color was a bluish scarlet, but an artist would know that the true color of the ball existed only on a small part of its surface—a tiny crescent-shaped streak, on one side of which the color must be toned with black and on the other with more and more white until a spot was reached which is called the high light. Now let us apply this observation to work with which we are more familiar.

Suppose we dye at the same time the skeins of the same count, but differing greatly in the amount of twist. When they are dried and ready for inspection

*Paper presented at the spring meeting of the Piedmont Section, held at Greenville, S. C.

we show them to one of these supercritical color passers who will tell us in no uncertain words that they do not match each other by a mile (or some other equally accurate measure of color). In one sense they do not match; that is, if we are trying to obtain absolutely identical color impressions from two surfaces that are different physically. The yarn that has the greater twist has also more high lights that mix with the true color and possibly also more shadows, with the result that the color is flatter and grayer than the other. In cases like this common sense must prevail over idealism, and thus save another dyer from the madhouse.

High Light and Shadow

High light and shadow are two elements that enter into the effect of a color on the eye, but they are the gross form of a condition that extends down into the microscopic world. Every little particle of matter has its own high lights and shadows which affect the true color, and every color we observe may be analyzed into three elements, viz., reflected light, absorbed light and dominant chromatic hue. To put this in plain language, everything we see is a mixture of white, black and color.

White is a total reflection of all the light that falls on an object. Black is a total absorption of all light, while varying proportions of white and black produce the whole gamut of neutral grays. We must consider white, black and gray as color because they are the components of all colors we see.

True color, or chromatic hue, is suggested by the solar spectrum, but this is not very accurate and we are forced to construct an ideal spectrum to give the proper values. The solar spectrum lacks the tones between red and violet—our orchid shades, lavender and heliotrope, rhodamine and fuchsine shades—so we will construct in our mind a circular spectrum with all colors of equal value as colors and fill in the open space between violet and red. We start with 0° on the circle for red, shade over to orange at 60°, yellow at 120°, green at 180°, blue at 240°, violet at 300°. The colors between these fixed points are just as pure, just as important as the arbitrary six that mark the principal tones. No one has ever seen nor can construct anything to show these pure 100% colors; they must remain theoretical quantities. Now we will work in from the circumference of this circle toward the center, where we will place 100% white, and the entire circle will show all the possible combinations of the pure colors and pure white radiating from the white center to the full hue at the circumference. Again, no one has ever seen these tints in complete purity. Why? Because every color we see is also effected by a greater or less amount of black. Even a pure dye like Rhodamine or Chinoline Yellow has a little of the black element in it. I do not mean chemical or physical impurities, but that some of the light that falls on it is absorbed and is not reflected back to our eyes as either white light or as color.

Collecting All Known Colors for Study

Now if we make a thousand of these circles and to each add a thousandth part of black more than the one preceding we will find the diameter decreasing till the last one is only a point of black. Trim away the outside and the pile will form a cone which contains all the colors the human eye can perceive, and we are ready to admit that our imagination cannot conceive of any other colors than these.

This is not high-brow scientific stuff; it is merely the making of an orderly collection of the colors we know in our everyday life. Now that we have them collected let us study their relations.

The first circle, containing no black, will serve well. The red is opposite green, blue opposite orange and violet opposite yellow, and each color on the circumference has an exact opposite. The colors opposite each other will neutralize each other completely and produce white, and all mixtures of two colors will lie on a line connecting them. How do these rules affect our daily application of dyes? Red neutralizes green and produces white, yet here I show you a skein of wool dyed with Fast Red and one dyed with Acid Green, and a third with the same two dyes dyed together, producing a black. This seems to contradict the theory, but it really does not; it really confirms what I stated previously—that all the colors we know contain black, that is, absorbed light. The pure red and the pure green have neutralized each other, and the black remains unchanged.

Let us consider pure orange. Now try to make it by mixing red and yellow. Draw a line from red to yellow and it will fall a third of the way inside of the circle, showing that some color is lost. Now if we are dealing with commercial dyes there will also be some black left over and the mixture of red and yellow has given us only a dirty orange instead of the pure shade. By using a yellower red and a redder yellow whose connecting line comes nearer the orange point on the circle, the result will be better. We can match shades by the use of three dyes; we can make gray from red, yellow and blue. All dyers are using subconsciously the laws of color, but few know why they do so. A study of the relations of color will prove to be a great help.

Experiment with Filters

There are many phenomena of color which need explanation. If we take three color filters—red, yellow and blue—and put one over the other we cannot see through them, but if we put them in separate stereopticon lanterns and project the three colors on a screen, then move them till all strike the same spot we will get a spot of white light. In the first case, each colored glass held back certain rays and passed the others, with the result that all rays were stopped before they got through the three glasses. In the second case, each glass supplied certain rays and the total went to make white light.

In dyeings on any material we are dealing with both reflected and transmitted light so that judgment and experience are better guides than theory. Consider any dystuff—the powder, the paste, the solution and the dyeing—all differ in color and yet the color phenomena are all produced by the same chemical substance. However, a little of the theory judiciously mixed with your own practice may be a benefit in the long run.

Beam Dyeing*

By F. H. McCoy
Lowell Manufacturing Company

BEAM DYEING, as we all know, has its advantages and disadvantages, and it has made a place for itself in the manufacturing of cotton goods. This system of dyeing is being used extensively throughout the South. It has proven very satisfactory not only from the dyeing viewpoint but for pattern work where a number of dyed beams are put back of the slasher and the patterns made from the beam on which the yarn was dyed. Another feature is that each set of warps can be dyed in just the amount of yarn required, and practically no waste or pieces of dyed yarns remain.

Now, to get more closely to the subject of dyeing itself, the importance of preparing the beam for the dye machine cannot be stressed too much. Unless the winding is properly done, all sorts of bad dyeing will result. The beams must have a uniform density from end to end. When the liquor is circulating through the beam, it is going to follow the course of least resistance; and should there be tight and loose places in the beam, a streaky warp will almost invariably result.

A density control device on the winding machine is, I think, a great asset to dyeing. This device makes the beams soft and spongy, and also laces the ends together so as to prevent blowing or channeling. The selvedges must also be very carefully guarded in the winding process, for a lot of trouble can come from a selvedge either too soft or one too hard. If the selvedge is too soft the liquor will blow out around the end, and if it is too hard a few ends are apt to come out not dyed or partly dyed.

The contraction of yarn on the beam is another interesting and important feature in dyeing. Contraction of the yarn before the dyeing operation is completed will very often cause the center of the warp to be lighter in shade than the ends.

In my observation, carded yarns contract more than combed yarns and there is very little or no contraction at all in mercerized warps. Therefore, a carded warp should be more loosely wound than a combed warp. And unless a mercerized warp is wound very firmly the liquor will flow through the beam in a spiral, causing a heavy streak in the beam and spiraling around the beam from end to end.

Speed Needed in Wetting Out

The boiling out, or wetting out, should be done as quickly as practicable, and the dyeing operation carried out before the yarn loses its original density and build. Then, if the spiraling or channeling occurs in the finishing operation it isn't so detrimental to level dyeing.

On vat colors where strong caustic solutions are used, and also where high temperatures are necessary, we are certain to have a great deal of contraction. And this contraction, as stated above, it likely to cause trouble. A real firm warp not only causes trouble in the dyeing but in the drying process. When warps are dried on the dye beam they will dry much more quickly when soft.

In dyeing vat colors on the beam one must see to it that the stuffing boxes are kept well packed so as to keep any air from being drawn into the pump; for when this occurs the pump does not function properly, and at the same time the air getting into the bath causes undue oxidation, and this, of course, will ruin the process of dyeing. The overflow pipe into the expansion tank should maintain a steady, even flow of the liquor. When the overflow is irregular and air is coming through with the liquor, there is something wrong somewhere about the machine.

The pumps on the machines are equipped with impellers to suit the needs of the unit. One pump may do the work for one beam, two, three or four. The difference in size of the impellers may not be very perceptible, and yet the volume of flow may be vastly different.

The Equipment

The machines with which I am most familiar are equipped with centrifugal pumps. On a two-beam unit the pump usually pumps 550 gallons per minute, and on

*Paper presented at the spring meeting of the Piedmont Section, held at Greenville, S. C.

a three or four beam unit it pumps 750 gallons per minute.

On a pump of this kind it is interesting to note that volume and pressure are reciprocal. The higher the pressure the lower the volume, and vice versa, until the maximum pressure or volume is obtained. And since the volume efficiency is lowered with increasing pressure, it is obvious that a soft wound package is very important and necessary to good level dyeing.

A very good size of perforated beam to use is a 20-inch barrel, used in a kier 34 by 72 inches. This size kier will hold approximately 250 gallons, including the usual amount in the expansion tank. This makes a ratio of 8 1/3 pounds of liquor to 1 pound of yarn; or, in other words, 1 pound of yarn per gallon of liquor. With 90 per cent efficiency of the pump, we should have the 500 gallons passing the beams each minute.

The Sulphonation of Textile Oils*

By E. L. Fletcher

Manager of Production and Research, Burkart-Schier Chemical Company

In the following remarks on the subject of sulphonated castor oil the practical side of the product, only its objects and its preparation, will be featured. The technical or scientific phases will be referred to only as necessary. The technology is amply covered and undoubtedly familiar to those of you who would care for this side of the question.

The Product and Its Properties

The literature states that Turkey Red oil is the alkaline salt of ricinosulphuric acid together with unaltered oil. Many authorities claim the product to be far more complicated than this, forming several different polymers of ricinosulphuric acid, only some of which are completely neutralized, or all partially neutralized to form a desired Turkey Red oil. We workers in the field are generally inclined toward the theory of a multiplicity of compounds rather than one definite compound being formed. Indeed, the behavior of castor oil during the action of acid and oil in the first process leads one to the belief in the statement of Knecht that "An etherification takes place with the separation of water." This tends to explain the internal heat generated in the acid and oil mixture. That many different products are derived from this agrees with the wide variance in temperatures obtained at this stage. Many operators add a little water to raise this temperature if the mix is inclined to stay cool or run slow.

It is this peculiar complicity of differently formed products that render the substitution of other oils in place of castor oil, and adulteration of sulphonated castor oil with other sulphonated oils impractical and unlikely.

The consumer of sulphonated oil has become very discriminating, and the use of other oils, however well prepared, would hardly meet the demand of the trade. Other oils can be sulphonated but not with the same results as castor oil throughout, and it is not only the function of a sulphonated castor oil that the present-day consumer demands, but that of a very high-grade sulphonated castor oil.

Just a word under this heading relative to what a 50% sulphonated oil and what a 75% sulphonated oil is.

All systems of percentage are in common use. The actual fatty content; the non-volatile matter and the per cent water. Usually at 50% oil means 50% water and 50% total non-volatile matter. This appears to be the best and easiest understood of all the systems of description. From the consumers' end it is simple. From the manufacturers' end it is also simple in that the regain from the acid and soda added very closely compensates the average loss of glycerine during the processing so that in saying a 50% oil it is very nearly saying "One-half this oil is that equivalent of castor oil used." Costs must be figured from the amount of oil necessary to produce a given unit, and it appears that if this nomenclature could be standardized it would clarify things considerably.

The Functions of Sulphonated Castor Oil

In the scope of application and variety of uses there has been a vast change within the last several years. At the time of the writing of most methods of preparation of Turkey Red oil, and indeed when most of the intensive investigation on what was the desired result took place, the use was limited to direct use in the textile field. By direct use is meant use alone to aid a given definite result, such as a leveling agent in the dye bath.

Since then, however, there have been all manner of new uses developed, and that which was formerly regarded as perfection has changed and been modified. Sulphonated castor oil is not only used alone for textile purposes, but it is one of the main bases of a multitude of other textile products such as developers, penetrants, kier compounds, and it is used in various sizing preparations. It is used considerably in the leather industry and as an emulsion base in cutting oils and compounds. All these different uses naturally affect the resultant product and change the idea of what is sought.

*Paper presented at the spring meeting of the Piedmont Section of the American Association of Textile Chemists and Colorists, held at Greenville, S. C.

It used to be that if a Turkey Red oil went into clear water solution rapidly it indicated merit; the clearer and quicker the better. To accomplish this—other things being equal—an oil had but to be more heavily neutralized in finishing. That is, its free fatty acid content had to be reduced to a very small number nearly neutral. Frequently oils were met slightly over the alkaline side. These oils did not have to be washed nearly so thoroughly as is done to-day, for a little sodium sulphate left in solution does not affect harmfully the solution on test nor settle out of an oil of low fatty acid content on storage. It did not materially affect the limited function of an oil of that day. Now the worth and criticism of a good Turkey Red oil for textile usage has changed into how strong a salt solution will it withstand and how little effect will a mineral acid, or acetic acid, media have on it. The test which an oil must stand to-day to pass will probably be to see if there is an oily separation on standing after the addition of 10 c.c. of 5% sulphuric or acetic acid solution to 50 c.c. Turkey Red oil 10% strong. To satisfactorily pass this test the following changes in manufacture are necessitated:

1. Double sulphonation or its equivalent in washings. Necessary to remove all traces of sodium sulphate used and formed when the excess sulphuric acid is neutralized. If any sodium sulphate remains in the product it will either separate out in a watery layer in the barrel or drum on storage or it will render low the oil's ability to withstand salt solutions, which is liable to cause spotting when used.

2. It is necessary to finish to a high fatty acid content and this means that a very high degree of sulphonation must be obtained in the first process—that of adding the sulphuric acid to the oil.

Whereas in the old days castor oil could always be sulphonated on the safe side of temperature and be handled mildly throughout with the knowledge that on finishing enough alkali could be added to take care of the solution of any unattacked castor oil remaining, to-day it is necessary to very nearly sulphonate all raw castor oil used.

It is this fact that protects the user against substitutions of other oils in place of castor oil and against the dilution of sulphonated castor oil with other sulphonated oils. The chemical character of castor oil is such that it takes sulphonation to a greater degree and in a different manner than do other available oils, and, as was stated above, the consumer now expects a performance from his Turkey Red oil that not only precludes the use of any other oil, but, in the majority of cases, demands the use of the very highest grade and purest castor oil obtainable. Other oils when sulphonated usually do not begin to resemble castor oil, insofar as textile expectations are concerned, until they are finished either neutral or alkaline, and by that very fact they have removed themselves from possibilities for use in this field on account of being too prone to settle out in acid media or in strong salt solution.

The above remarks on sulphonated oil, other than castor oil, do not strictly apply to cod oil. Sulphonated cod oil was not considered for textile use on account of its general physical characteristics and not from result on sulphonation.

The Preparation

The classical method of sulphonation is well known and well written. Briefly stated it is:

Add about 25% concentrated sulphuric acid to the oil during constant agitation, never to exceed a temperature of 105° F. After all acid is added agitate for about three hours longer, not exceeding 105° F. at any time. Quence and wash with Glauber salt solution; settle; wash; drain off. Neutralize excess sulphuric acid; drain off; wash. After thoroughly washed—until all salts in solution are removed—bring to desired strength and neutralize with caustic soda solution, or ammonia, until clear water solution is attained.

This method is good in that if sufficient time and care is taken it will produce fairly good duplication of results without laboratory control and without the use of particularly high-class operators. It is deficient in that it is doubtful if it will not always leave too much unaltered oil to function properly in the various acid and salt solutions wherein it is now used. Formerly any type kettle with a simple agitator and a bottom draw-off would serve, and if there were sufficient time to control temperatures by slow addition no cooling devices were necessitated. Now to sulphonate oil on a commercial scale batteries of at least two kettles are necessary in the case of batch processing, and three kettles in case of continuous processing. These must have rapid agitation, both heating and cooling devices sufficient to accomplish instant change of temperature, and minute control and supervision under adequate laboratory facilities. Partial sulphonation is no longer sufficient to produce a successful product, and where maximum sulphonation is desired the equipment must be such that extremely rapid control is possible, for when the action is carried too far the result is such that the oil can no longer find use under present requirements.

SUMMARY

1. The current Turkey Red oils are judged mainly by ability to stay in solution in acid and salt solutions.

2. Turkey Red oils must be of a high degree of purity to meet present conditions of storage and usage.

3. A satisfactory oil to meet sales competition practically must be all castor oil; not only that but a high-grade sulphonated castor oil. A mediocre product will not meet the expectations in performance.

4. It has become necessary to endeavor to break up the maximum amount possible of original glycerine. Merely working toward minimum limit of solution will not suffice. This necessitates carefully designed processing units and ample technical supervision.

COMMUNICATION

Fastness: The Silk Dyer's Problem

By RAYMOND CURTIS

Bradford Dyeing Association (U. S. A.)

EVERY dyer has, of course, to face the problem of fastness; but the nature of the silk dyer's problem calls for a very wide knowledge and a particularly nice interpretation of dyestuff properties if he is to reconcile the claims for fastness with the necessity of satisfying other exacting demands—such as high luster. It is useless to tell a customer that dyed tub silk is fast to boiling soap if it looks as though it had been in contact with a flour bag; after all, she is buying *silk*, and not a fast washing proposition. So that while the silk dyer has practically the whole range of dyestuffs to select from, the difficulties and cost of applying them vary so enormously that these considerations rather than the desirable degree of fastness become the deciding factor. To take again the case of tub silks, these ought to have very good washing fastness, and this for many shades could be obtained with vat and mordant colors; but in the ordinary course of events the dyer makes his selection from acid, basic and direct dyestuffs, and gives the purchaser a washing fastness which, while poor compared with washable cottons, is generally accepted as satisfactory.

It is really this difference between the fastness properties of dyed cotton and silk which aggravates the silk dyer's problem. At one time, except perhaps for blacks and embroidery silks, the silk dyer ladled out basic, acid and natural coloring matters oblivious of the word "fastness." With the development of the dyestuff industry, faster and still faster dyestuffs were discovered, enabling the cotton dyer not only to meet a demand for better fastness but actually to stimulate it. The silk dyer had either to give similar fastness or show good cause for not doing so; and while in many cases he has had to choose the latter course, he realizes that the demand for better fastness remains and that until it has been met he can never rest satisfied.

The two following requests for improved fastness are instances of the unsettling effect of dyed cotton on well-established silk ranges:

1. Complaints were made of the light-fastness of the colors in a range of silk sewing threads (for men's wear, buttonholing, etc.), although no change had been made for years in the dyestuffs used; and it was stated that they compared very unfavorably with a similar range of cottons. The dyestuffs chiefly used for the silk range were orchil extract, turmeric and Indigo extract, and the silk was weighted almost to par with sumac. The cottons were dyed with direct colors of the best possible light fastness, but it was not found possible to substitute either these or the fast-to-light acid colors for the dyeing of the silk. Improvements, however, in the light fastness of the light and medium grays and fawns could be, and were, made, and the resulting modified range, although inferior in point of light fastness to the cotton range, proved to be quite acceptable to the trade.

2. There is a large demand for sewing silks (mostly for women's wear) for which no particular fastness is ever claimed, but for which the standard of matching is very high. Complaints were made of such a range that the silks bled when washed, but that sewing cottons fast to washing were easily procurable. The latter range includes less than 100 shades, whereas the silk range includes over 500 shades; and while many of these could be produced fast to severe washing, the slight gradations of shade made the dyeing of any such wide range quite impracticable. Finally, a wider range of colors than in the vat and sulphur dyed cottons was given by using selected basic and direct dyes, back-tanned. These shades, while not nearly so fast as the vat colors, quite satisfactorily met the washing fastness requirements.

FASTNESS RESEARCH BRINGING GROUPS TOGETHER

It will be realized that considerable experience is necessary to gauge correctly fastness requirements and to interpret fastness tests in the light of these requirements; and it is in this connection that the work of the A. A. T. C. C. in bringing together all interested groups in the question of color fastness can be of very considerable help. The case cited by Dr. W. M. Scott (AMERICAN DYESTUFF REPORTER, page 189, 1928) of some discharge silk prints which in actual wear were of satisfactory light fastness, although exposure tests would seem to condemn them, illustrates this point. Some years ago the writer was asked to dye up a range of about ten shades on fine silk (organzine) for brand tabs in shirts, underwear, etc., the range to include very bright full shades. The shades had to be guaranteed and the manufacturer specified a fast-

ness to boiling soap. It was obvious that either the shades or the fastness would have to be modified, and it was decided that a washing fastness that was about equivalent to Class I (wash fast) of the American Association of Textile Chemists and Colorists would be quite safe. The range was made with mordant colors on alum and a few selected basic colors back-tanned) and no complaint of the washing fastness was ever received.

While the yarn dyer's problem is wholly concerned with the dyeing of silk, that of the piece dyer is frequently complicated by other dyeing considerations. Whereas in dyeing a silk-viscose fabric for underwear it is very desirable that the color should stand up to a mild washing treatment; on the other hand, unless non-barring dyestuffs be used for dyeing the rayon it is possible that much of the fabric will be unsalable. Some of these colors on silk have very poor fastness to water, washing and light, and are not good union dyeing colors. Yet the silk dyer may have to sacrifice these properties for their other valuable characteristic. This limitation in the dyer's choice of dyestuff may always occur when some special condition has to be fulfilled, as in the case of cross-dyeing. No matter what fastness requirement was desirable on a cross-dyed silk-cotton cloth, the choice of silk color would be practically limited to the acid class and it would be a question of selecting those acid dyestuffs the fastness properties of which most nearly approached the requirements.

Requirements That Must Be Considered

Ignoring some special fastness requirements, such as fastness to perspiration, and those requirements which are more the concern of the manufacturer than the public, such as fastness to rubberizing, degumming, etc., the silk dyer has to recognize the following well-defined requirements:

1. Fastness to water.
2. Fastness to domestic washing.
3. Fastness to repeated washing without any appreciable change of shade or bleeding into white.
4. Fastness to light—either alone or combined with any of the other requirements.

Fastness to rubbing (crocking) is not generally specified, but it is almost always understood that a dyeing must have good fastness in this respect. This has some bearing on the dyeing of washable silks; for, strangely enough, some dyestuffs with good washing fastness (such as the Janus colors and Victoria Blue B) have poor fastness to rubbing. Not infrequently dyeings of Royal Blue which satisfy the severe washing test (170 to 180°) will be rejected because of crocking.

Special Requirements

Umbrella silks, as well as silk for flags, hat bands and trimmings exposed to the weather, must obviously be fast to water (rain), while frequently dress silks and silks for upholstery are required to be fast to water. It is important, too, to dye the silk fast to water in cross-dye union fabrics. The importance of water fastness is very generally recognized in Europe, and particularly so in France; but here, apparently, there is not the same importance attached to this property, and our association has not formulated any standard test. While most dyestuff manufacturers in their silk pattern cards and handbooks list the fastness to water, it is very important that the silk dyer test every likely color in light, medium and heavy shades, as well as the effect of back-tanning. Many of the colors useful in palish shades, such as the Amido Naphthol Reds or the Cyananthrols, are unsatisfactory in heavy shades. In most cases it will be found that back-tanning converts a dyestuff with borderline fastness into a safe one, and with many dyers this method is invariably used for dyeings fast to water.

It seems to be generally agreed, both here and in Europe, that if dyed silk goods will withstand a careful washing at temperatures up to 40° (or about 100° F.) without appreciable loss of color, they can be considered as satisfying the domestic washing test. In view of the importance of this temperature (emphasized at the February meeting of the New York Section by Mr. Freedman, of Macy's laboratory, as representing the purchaser, and at the Annual Meeting by George H. Johnson on behalf of the laundries), it seems a pity that the Association, in formulating their standard tests, should choose 85° and 120° rather than the intermediate one of 105°. Certainly the dyer who has to meet this washing requirement in every conceivable shade wants to know the maximum range of dyestuffs satisfying this washing test, and in testing out any new dyestuffs will naturally apply the 105° test rather than the temperature recommended by the Association.

Although the public has been educated to the difficulty of dyeing silk fast to washing, so that laundries and housewives generally use only the mildest washing treatment, there are cases where the silk must have very good washing fastness or be useless for that particular purpose. The instance already noted of makers' tabs is one, while others are silk striping in shirts, silk bindings on underwear, darning silk for mending stockings, and embroidery on washable goods.

Dyestuffs which satisfy tests I or II of the Association will generally meet the washing requirements, although the temperature chosen for the latter test (160° F.) is rather on the low side of what is safe. With few exceptions these colors fall into the vat, mordant, sulphur or

developed classes, all of which present special problems to the silk dyer. There are, however, a good many instances where good washing fastness is required and which, on the grounds of shade, price or difficulty of dyeing, cannot be met with dyestuffs from Class I or II. It is in trying to meet this demand that the silk dyer's knowledge of dyestuff properties is taxed to the utmost. By making a careful selection of dyestuffs from the Janus, Polar, Neolan and Setamine classes, by choosing the fastest to washing of the basic, direct and acid colors, and back-tanning in all cases, a wide range of shades with good washing fastness, both on weighted and unweighted silk, can be obtained. But obviously the term "good" is capable of very varied interpretation; assuming that a particular dyeing can be graded as our Class II (washable)—that is to say, it can be washed at 120° without appreciable loss of color or staining—it has still to satisfy the purchaser in actual performance.

The following experience illustrates the uncertainty of doing this. A range of mending silk shades (for darning all kinds of silk stockings) was brought out, all of them fast to the customary washing test at 50° C. (122° F.). The trade expanded rapidly with the vogue of rayon stockings, and with it the number of complaints regarding the poor washing fastness. Although less than one in a thousand purchasers complained, the annoyance so caused made an investigation of the matter necessary. It was found that although the dyeings satisfied the washing test, most of them after a few domestic washings lost their original tone—the degree depending on the severity of the wash—and the darn was no longer a match to the stocking. It was realized that the same difficulty would be experienced even if the washing test temperature were pushed up another 10°, and that only by making the dyeings fast to most severe washing could the claims be completely eliminated. The only dyestuffs that could satisfy these demands were vat colors and selected mordant colors on a chrome mordant. Despite the increased cost and the difficulty of dyeing these colors satisfactorily, it was decided that the freedom from annoying complaints and the increase in business to be expected would justify the change. As a matter of fact, these expectations were fulfilled and no claim was ever received from users of this silk.

The occasions, however, when such a solution of the fastness problem is possible are few, and all that the dyer can do is to give a "reasonably good" washing fastness which is consistent with the other conditions imposed upon him. The dyer must then be prepared for occasional complaints and must take the stand that the purchaser has overestimated the degree of washing fastness and is demanding something that neither he nor any other silk dyer is prepared to give.

Value of Light Exposure Tests

During the past few years an enormous amount of work has been done upon light fastness, indicating the complex nature of the factors influencing fading. It should be realized, however, that though a particular dyestuff may vary in its resistance to fading, any classification of fastness based on exposure to sunlight will satisfy average conditions. The dyeings of all dyestuffs likely to interest the dyer should be made on silk and exposed to sunlight along with the dyer's own standards—or those suggested by the British Silk Research Association in their pamphlet "Fastness of Dyes on Silk"—and with a classification so made the dyer can safely choose his colors so as to know with some degree of certainty how his fastness compares with the best possible light fastness. Just as in the case of washing fastness, there is the problem of reconciling fastness requirements with other important considerations.

In Europe a considerable amount of fine silk (organzine and tram) is dyed for school and college hat bands, badges, blazer pockets, etc., for which good light fastness is very desirable and fastness to rain is essential, and the whole field of direct and acid dyestuffs is very carefully culled to meet these requirements. As one would expect, however, there are frequent complaints regarding the light fastness, and while in some cases the fading can be traced to some special cause, such as exposure to sea air, generally the fading is the result of excessive exposure to light. The only possible way of eliminating or reducing to the minimum such complaints would be to have a range of shades drawn from selected vat colors. When a particular manufacturer was approached on the matter he was quite prepared to pay the price asked for vat dyeings, but he stipulated that there must be no loss of luster, the matches must be exact and to the patterns which he would supply. In other words, fastness was merely a secondary consideration, the essential condition being exact matching to an unlimited number of shades. Needless to say, there was no vat color range forthcoming.

Since then evidence has accumulated to show that the tendering of silk by sunlight seems to be more marked on vat dyed silk than on silk dyed with the ordinary colors; which, if invariably so, weights the scales still further in favor of selected direct and acid colors for good light fastness on silk. Some dyers claim that while the effect is not so noticeable as with tin-weighted silk, an aftertreatment of thiourea materially improves the stability of all unweighted silks

to sunlight exposure. Although this view is not generally accepted, there does seem to be general agreement among silk dyers that silk weighted with sumac has increased resistance to the tendering action of sunlight, and where the shades will allow of it, it is customary to use this along with the direct and acid colors of good light fastness on yarn-dyed silk. The belief is also very widespread and seems to be an article of faith with dyers in France that the light fastness in colors on sumac-weighted silk is very considerably improved, but except in the case of some basic colors the writer has yet to be convinced of any such appreciable improvement.

Often light fastness—as in the case cited above—is required along with some other fastness property, and it may be necessary in the case of some shades to decide which fastness has the prior claim. In the case of silk hat bands water fastness is absolutely essential, but in a tapestry which called for light and water fastness the former would have preference. Thus in dyeing a heavy violet shade for hat bands Wool Fast Violet B shaded with Violamine 3B would probably be used, while for tapestry Alizarine Brilliant Violet R, with its better light fastness, would be preferred.

Inferior Fastness Should Be Known

It is inevitable, of course, that many brilliant shades for which there are no direct or acid colors of good light fastness available, should be asked for with this property.* But the practice of dyeing such shades without in any way intimating to the manufacturer or purchaser that the light fastness is inferior cannot be too strongly condemned. In case of complaint the dyer knows he has the excuse that it is the fastest dyeing possible for that particular shade, but not infrequently the purchaser takes that shade without any idea of its inferior light fastness and would have been quite prepared to take a flatter shade or a different color in order to have good light fastness. The writer knows of an instance where months and months of work on hand embroidery were wasted through the inclusion of bright basic greens in the pattern when softer greens obtainable with the Alizarine Direct Greens could have been employed.

This well illustrates the need for some system of communication regarding fastness properties between the dyer, manufacturer and purchaser. If agreement can be reached on these requirements and on the necessary tests for determining them, then the silk dyer will find many of his fastness problems very much simplified.

*It is claimed for the new Auxamine B (1G) that it makes basic colors reasonably fast to light; whether sufficiently so as to make them more serviceable in this connection remains to be seen.

Fastness: The Silk Dyer's Problem

Reviewed by the Chairmen of the Silk Section of the Research Committee of the A. A. T. C. C.

IN this article the author has very ably expressed the viewpoint of the silk dyer on the much debated question of fastness. The Sub-committee on Silk of the Research Committee of the American Association of Textile Chemists and Colorists welcomes all contributions of this nature, because it is only by looking at the problem from all angles that we will be able to arrive at a satisfactory solution.

We wish, however, to discuss several points raised by the author in order to clarify the situation and emphasize the reasons for the adoption by the committee of the washing tests for silk as they appear in the 1927 Year Book. The author comments upon the fact that the purchasers of silk and the laundries which wash silk goods agree that silks should not be washed at temperatures exceeding 100° to 105° F.

This fact has long been recognized by the silk committee of the A. A. T. C. C., and our Association from the start has lined up with the Silk Association of America in recommending that 100° F. be considered the official temperature for the practical washing of silks. The purchaser, however, is not satisfied if the dyed silk will only stand one washing at the above temperature. He or she expects it to hold its color reasonably well through a number of washings, ranging possibly from five or six up to fifteen or twenty. A good many dyers do not take this into account and therefore assume that their dyeings are satisfactory if they will stand one short washing at 100° F., a conclusion which is obviously erroneous.

Temperature in Testing Washing Fastness

In formulating laboratory tests for the purpose of classifying the washfastness of dyed silks, the committee debated for some time whether to vary the factors of time or of temperature in order to increase or diminish the severity of the tests. It was felt that the temperature variation offered many advantages from the laboratory point of view, chief among which was a great saving in time, especially when there were many samples to be tested.

A number of experiments were carried out by which it was determined that the correlation between temperature and time variations was sufficiently close to warrant using the former variable as a basis for standard laboratory tests. For instance, it was found that the standard

laboratory test No. 2 (i. e., ten minutes in ½% soap solution at 160° F.) corresponded to about fifteen practical washings at 100° F., while the standard laboratory test No. 3 (i. e., ten minutes in ½% soap solution at 120° F.) corresponded to about five practical washings at 100° F.

It is felt by the silk committee that, although the standard washing tests as published in the 1927 Year Book represent the best practicable laboratory method for classifying the washfastness of dyed silks, these tests should be supplemented by a series of practical washing tests from time to time. This situation is analagous to the use of the Fade-Ometer for testing fastness to light. The Fade-Ometer is a very convenient instrument for routine laboratory fastness tests and has been used with great satisfaction by a large number of silk manufacturers, but the work of the Sub-committee on Light has shown very clearly that it should be supplemented from time to time by standard *sunlight* exposures.

The New Laboratory Washing Machine

The development of a laboratory washing machine will facilitate the making of practical washing tests in the laboratory. Under the efficient direction of William D. Appel at the Bureau of Standards, such a machine has been perfected and it is hoped that this will become part of the standard equipment of a textile laboratory in the near future. With such a machine any number of practical washings may be carried out in a standard manner to supplement the routine ten-minute laboratory test.

Another criticism made by the author of the article on fastness is that the temperature of 160° F. is too low to be safe for embroidery and darning silks, as well as for silk striping in shirts or silk bindings on underwear. The silk committee believes that this is a question which each individual manufacturer must decide for himself. If he wishes to be perfectly safe he can adhere to the requirements for Class I (i. e., fastness to ten-minute immersion in ½% soap solution at the boil). On the other hand, it must be recognized that 160° F. represents the minimum limit for Class II, and that if there is a perceptible alteration in color in test No. 2 the material will take a lower classification.

Of course, in domestic washings it is not always the temperature of the soap bath which causes alterations in the color of dyed silks. One illustration mentioned in this article was undoubtedly occasioned by other causes. We refer to the case where certain colors on mending silk were aftertreated with tannin so that they were fast to the standard washing test at 120° F., but lost their original tone after a few domestic washings. We believe that the alteration in color was caused by a certain amount of iron in the water which reacted upon the tannin in the silk. We have seen a number of complaints which were definitely traced to this cause.

The silk committee of the A. A. T. C. C. agrees heartily with the writer that there is great need for some generally accepted system of communication regarding fastness properties between the dyer, manufacturer and purchaser. The officers of our Association recognize this need and are endeavoring to obtain recognition for the tests which have so far been developed as a result of the painstaking work of the Research Committee. It is earnestly hoped that all of our members will do everything in their power to back up the officers in these efforts.

For the Silk Committee:
Walter M. Scott.

Members Admitted

Following are the names of those admitted to membership in the A. A. T. C. C. at the meeting of the Council held June 22:

Active Members

Alet, Henri J., superintendent, Vaucanson Dye Works. Address: 27 Ferguson Avenue, Port Jervis, N. Y.

Barker, Wyss L., demonstrator. Address: National Aniline & Chemical Company, Charlotte, N. C.

Bick, Carl E., superintendent of dyeing, Real Silk Hosiery Mills. Address: Indianapolis Athletic Club, Indianapolis, Ind.

Boyle, Henry G., assistant overseer, United Nets Corporation, Central Falls, R. I. Address: 26 Hyde Ave., Pawtucket, R. I.

Caspe, Joseph, director of laboratory, Gaskill Chemical Corporation. Address: 355 Van Buren Street, Newark, N. J.

Crawford, John W., mill superintendent, G. H. Tilton & Son Company. Address: Box 143, Tilton, N. H.

Danley, Mary M., director of laboratory. Address: Jos. Horne Company, Pittsburgh, Pa.

Dobbins, B. J., plant manager, National Yarn & Process Company. Address: Box 343, Rossville, Ga.

Edgerton, Earle M., colorist, Superior Piece Dye Works, Long Island City, N. Y. Address 28-44 Thirty-fifth Street, Astoria, L. I., N. Y.

Feit, Al J., demonstrator, Newport Chemical Works. Address: 2723 Ward Street, Chicago, Ill.

Gerry, Henry S., superintendent, Superior Piece Dye Works, Long Island City, N. Y. Address: 2363 Crescent Street, Long Island City, N. Y.

Goldsmith, Wm. Jr., foreman of dyeing and chemist, Lowell Bleachery South No. 2. Address: Box 205, Griffin, Ga.

Gunter, Chas. W., superintendent, Mooresville Bleachery. Address: 42 W. McLelland Avenue, Mooresville, N. C.

Larrat, Louis, foreman dyer, Lyons Piece Dye Works. Address: 230 Fifth Avenue, Paterson, N. J.

Mobley, W. K., color chemist, National Yarn & Process Company. Address: 603 Chickamauga Avenue, Rossville, Ga.

Mullis, Murphy B., textile chemist. Address: 812 S. Boulevard, Charlotte, N. C.

Neiman, Howard S., editor, Textile Colorist. Address: Woolworth Building, New York, N. Y.

Price, Fred, dyer, Sweetwater Hosiery Mills. Address: 162 Main Street, Sweetwater, Tenn.

Reall, Edward A., chemist and dyer, Geneva Mill, Wanskuck Company. Address: 22 Seamans St. Providence, R. I.

Rupp, Raphael E., chemist, Pacific Print Works, Lawrence, Mass. Address: 48 High Street, Methuen, Mass.

Scharschmidt, Paul H., dyer and finisher, Hamilton Woolen Company. Address: 442 Hamilton St., Southbridge, Mass.

Skinkle, John H., instructor. Address: Department of Chemistry, Lowell Textile Institute, Lowell, Mass.

Sloan, Robert D., dyer, National Yarn & Process Company. Address: Box 485, Chattanooga, Tenn.

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Further Comment Concerning the Testing of Wetting-Out Agents

Editor, AMERICAN DYESTUFF REPORTER:

I notice in the May 28 issue an article by H. O. Roberts on the testing of wetting-out agents in which Mr. Roberts describes, among others, the method proposed by L. C. Lawrie, of the British Dyestuffs Corporation, which method first received publicity in America in the REPORTER'S account of a paper read by me at the Rhode Island Section (A. A. T. C. C.) meeting.

In describing this method Mr. Roberts quotes practically verbatim from my paper, but omits the last half of the description including the method of procedure. Therefore, in justice to Mr. Lawrie might I ask you to print again the entire method, which is as follows:

"Briefly the method proposed by Lawrie depends on the observation of the length of time taken by a definite volume of the wetting-out solution to wet out and flow through a piece of cloth of exact size under certain definite and easily controlled conditions.

"The apparatus consists of a burette of a capacity of 25 c.c. which is filled with a solution of the substance under examination and which discharges into a short length of wide glass tube, the diameter of which should be in the neighborhood of 40 mm. The upper end of the tube is open and placed directly under the burette, while the opposite end is covered with a piece of standard cloth, held in position by means of a strong rubber band.

"In the experiments performed in the laboratories of the British Dyestuffs Corporation the cloth used was a Botany worsted serge of the average type used for men's wear and work in our own laboratory here seems to confirm that such a type of cloth is best suited for the purpose of the test.

"Experiments have also been conducted with cotton cloths of various types, but the results are not so accurate, so far as we can determine at present; a cotton broadcloth has given the best results so far and perhaps may prove entirely satisfactory with a variation in the diameter of the tube.

"The piece of tube is so placed beneath the burette that the distance from the cloth to the tip of the burette is 100 mm. The diameter of tube with a given quantity of liquid plays an important part in the test because this determines the head of liquid which, exerting a pressure on the cloth, accelerates the wetting out of the material.

"With tubes of smaller diameter and consequent larger head of liquid the penetration and the wetting out of the material takes place more rapidly, and there is no doubt that the test can be modified so as to obtain a satisfactory working time by varying the diameter of the tube according to the type of cloth used as standard.

"The apparatus is completed by placing below the cloth a small measuring cylinder marked at 20 c.c. and fitted with a funnel. The method of working is simple. The burette is filled with 25 c.c. of a solution of the wetting-out agent and this amount is run rapidly as possible into the tube. It is essential that the burette have a comparatively large orifice so that its contents are quickly discharged.

"With a suitable stop watch the time is taken from the moment of opening the burette tap until 20 c.c. of the solution have run through the cloth and funnel and collected in the measuring cylinder. The tests, of course, are all made strictly comparatively and with solutions of various strengths, of from 1 to 10 gr. per liter. The results may be shown in table form or in the form of a graph, if necessary, by plotting time against the strength of solution."

The last three paragraphs were omitted from Mr. Roberts' article but are all important. His criticisms of the method, therefore, should not be taken too seriously.

Yours sincerely,

H. R. DAVIES,

Dyestuffs Corporation of America.

EFFECT OF OVERLOADING UPON RINSING

OVERLOADING is one of the easiest committed and possibly one of the most commonly committed errors in washing practice. While overloading is practiced with the idea of economizing, the results usually defeat the purpose itself. Overloading is the downright enemy of good washing. If continually practiced, it will automatically do away with the fancied need for being practiced because the results of an overloaded wheel are invariably so poor in quality as to breed the dissatisfaction which leads to losing the customer.

Aside from the impossibility of properly washing an overloaded wheel, the overloading affects rinsing in a number of ways:

First.—There will be a tendency for the wheels to slow up. This naturally reduces the amount of travel or mechanical action.

Second.—Circulation is reduced because there is insufficient freedom of movement of the goods in the wheel.

Third.—The ratio of water to weight of goods required in good washing is reduced.

Fourth.—More time is required to accomplish the same amount of cleaning. This additional time will overwork the soap and lower its efficiency.

Fifth.—There is a continual tendency for off color and grayness.

Sixth.—The removal of supplies by rinsing is as important as the removal of dirt by washing. Without circulation of the rinse water, without time for penetration of the rinse water, without the mechanical action to squeeze the supplies out of the goods, the rinsing is incomplete and the quality of the finished load far below par.—Cowles Comments.

Practical Hints on the Production of Bright Colors on Textile Fabrics

Part XXXVII

Repairing Wooden Bowls—Differently Filled Padded Fabrics—The Equipment and Its Operation—Special Advantages

By RAFFAELE SANSONE

WHEN wooden bowls are employed on the padding machines, where the cotton fabrics are colored with the pastes containing the bright colors, they become worn after a time in some parts more than in others, and their pressing action is then irregular. In this way the goods often remain wetter in the center than at the sides, which are dyed somewhat lighter and appear thinner than the rest of the material. The trouble is generally remedied by sending the wooden bowls into the repairing shop, to be submitted to scraping or shaving operations, which render their circumference uniform all through, or by conducting such operations on the padding machines. For the purpose the small apparatus shown in Figs. 1 and 2 has been found useful, as by its means cylinders of the usual dimensions can be corrected within one and a half to two hours.

The machine contains a small steel blade A, held by bolts in a horizontal position which work in long, narrow

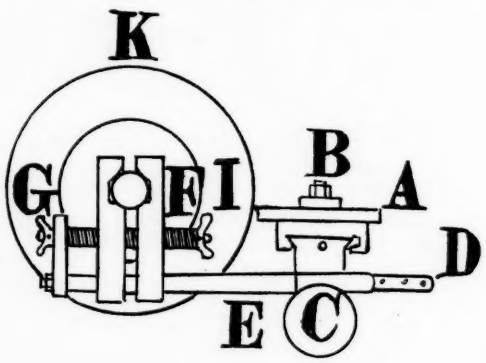

FIG. 1

holes. By this arrangement the sharpened portion I of the blade can be pushed forward so that it rubs tightly against the round portion or circumference of the wooden roller K, where the leveling process has to be conducted. Blade A is held on the copper headstock B, where it can be brought to the right or left for any desired distance on a sliding arrangement, through the assistance of an endless screw, turned by the small handle a. Here the blade remains fixed for any necessary length of time.

The end shafts of the bowl to be repaired are clutched by clamps F, the bottom portion of which slide in the two guide rods E. One end of these contains a short copper bush, furnished with the screw spindle G. By the latter, the hoofs are moved back and forth to clutch the end shafts while remaining perfectly straight. Care is taken that the small incavations D, on the guiding rods E, remain on the outside. The headstock B moves on guide rods E to approach drum K or some distance from it. The part of the mechanism below headstock B is fixed as indicated in figure with the small screws s, s, in the nearest of the sinking slots indicated by D, the frame supporting the same being held in position by moving screws z, z, which press plates C, C, against the side frames of the machine where the bowl is corrected.

When starting the smoothing and leveling operations, the small appliance is fixed so as to exert its action at the end of the roller, where a large layer of the wood has generally to be removed, letting it work here until no more wood can be shaved off. After this, the cutting blade A is moved forward while the wooden roller is still turning, to continue the shaving operation on a second portion, that is, just where the first cutting has been suspended. Successive treatments are then conducted until the whole of the round surface on the roller has become uniformly smooth. At this point the operatives rub the roller with emery cloth for some time, and after wetting it with water, place it again in use for the padding operations.

Differently Filled Padded Fabrics

When producing bright colors on the padding machine there is the marked advantage that the goods treated can

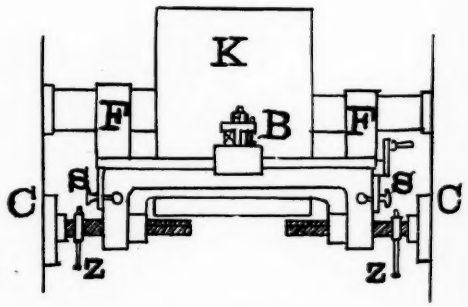

FIG. 2

be charged with varying weights of filling, taking up a different feel in each case, a smaller or greater strength, and changing more or less in appearance. In Fig. 3 is shown an ordinary white bleached cotton fabric before it

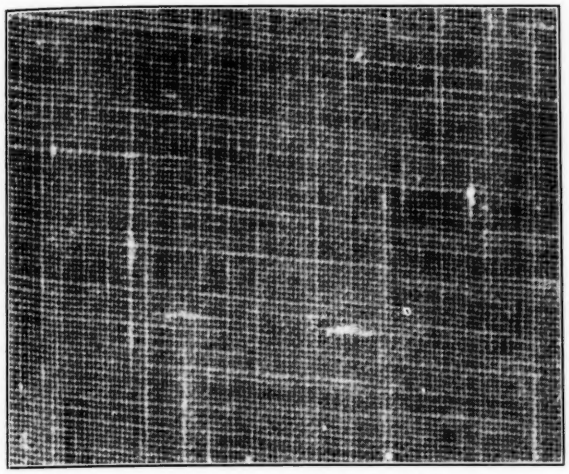

FIG. 3

is submitted to any treatment. As will be seen the texture can be easily observed; it is not difficult to count the number of warps and wefts per inch. When colored with a bath containing a light filling, the same fabric is changed as shown in Fig. 4, which gives an enlarged view of the same.

The threads assume in this case a swollen appearance, without the holes or interstices having been filled. The warp threads have taken up more size than the weft, not only for the reason that their twist and counts are lower than with the weft threads, but also due to the fact that during the padding operations they were submitted to more stretching, and that the color paste was rubbed longitudinally down the cloth. The differences in the thickness of the warp threads remains for this reason more marked than in the gray goods. The material, however, is still among the most satisfactory, for in its construction low-class raw materials cannot be employed without spoiling the appearance of the finished goods.

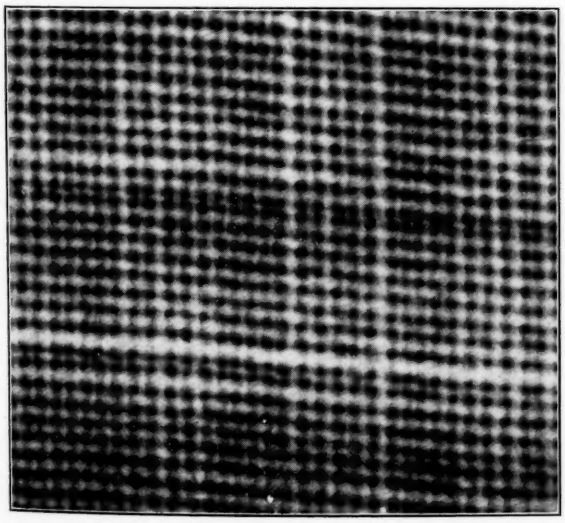

FIG. 4

To obtain a more intensive filling, the goods were treated with a much denser bath, which increased the size of the threads to such an extent both across the width and length of the above fabric as to cancel all intermediate holes, as shown in Fig. 5, giving the appearance of a close textured article of much greater thickness than that originally treated. The surface of the cloth remained, however, quite regular all over, while its "feel," because of the special nature of the bath employed, could still be kept at a certain softness. The effect was obtained by employing a padding machine constructed on the principle shown in Fig. 6.

Here are to be seen two semi-circular frames b, fixed firmly to the flooring of the works, the upper portion of which is joined to central rectangles a, at each side of

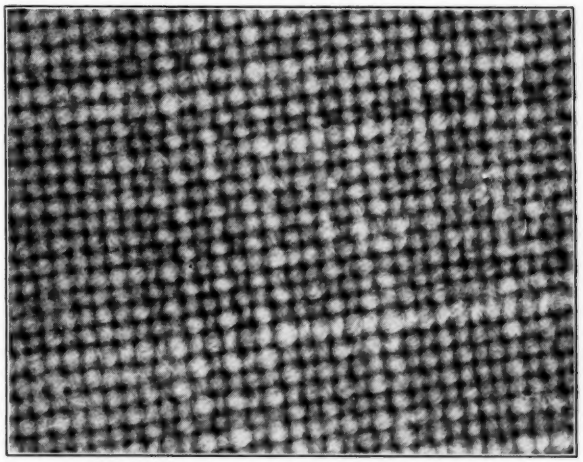

FIG. 5

which are slides containing the pairs of squeeze cylinders F and G, the lower unit of which is of copper-plated iron or Monel metal, and the upper of India rubber. Each pair of squeeze cylinders is kept under elastic pressure by means of screw devices, and special levers and the weights V, V. Above rectangles a is fixed at one side the pair of arms c with the spreading bars o, r, s, for entering the cotton fabric to be padded in full width, and on the other side the arms d. These contain wheel e and rod f moving plaiter g, that is surmounted by a Monel metal or copper-plated iron roller R, and has at the bottom the pair of small pressing rollers m.

In front of the semi-circular basement frames b is placed an entrance and tension-giving arrangement E; while below rollers F and G are the two wooden vats B and A of equal size, above which are bearings working under the action of springs, and containing a binding roller, for carrying the cloth from one trough to the other.

Both troughs have two lower and one upper guide roller, and a copper coil heated by steam separately, and serving to bring the baths of treatment to the required temperature. The lower metallic squeeze rollers are hollow, and in these circulates the steam that has served for the heating of vats B and A, entered through one of the end

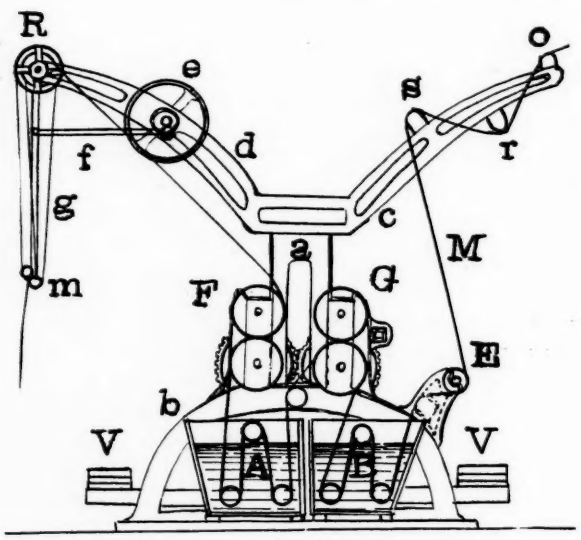

FIG. 6

shafts and freed of all condense water at the other by tubes fixed to steam traps. The machine is driven by a multiple speed electric motor, the yards of cloth treated per minute being registered by any ordinary meter for the purpose.

OPERATION OF THE PLANT

In the case of the fabric described above, the plant would be operated as follows: A strong, thick cotton tape is passed first on stretching bars o, r, s, making its way from here to the tension-giving arrangement E, and to the guide rollers in vat B, between the nip of cylinders G, on the intermediate tension-giving roller already indicated, on the binding rollers in trough A, across the nip of cylinders F, on roller R and between the small rollers m on plaiter g.

The cotton tape once entered, a bath of the color paste for producing a medium filling is prepared and a portion entered in vat B. Steam in the copper coil in the latter is turned on to bring up the temperature and keep it constant. When the above has been conducted, a second color paste is prepared, to produce a thick filling; this is entered in vat A, turning on steam in the other copper coil to warm to the necessary extent, the temperature, however, being kept higher in this instance than with the bath in vat B.

At this point the end of the cotton fabric to be colored is sewn rapidly to the end of the thick cotton tape, and the plant is started. The cotton material is thus drawn forward on bars o, r, s, where all folds are eliminated, especially if an operative watches its entrance, clutching towards the selvedges, and stretching often across the width. On leaving s, the fabric is pulled downward to the entrance arrangement E, which supplies it with an elastic tension, so that when in the first bath in B it is not unnecessarily stretched. In this way it mounts with the color paste uniformly distributed all through, cylinders G pressing out all excess of bath, so that when passing in vat A with a fixed quantity of this, it takes up quite easily a good dose of the stronger color paste in the latter; squeeze rollers F removing all excess. It can thus mount to roller R in a well-charged condition, and be delivered through plaiter g to a small hand truck in the form of pieces, ready for the drying and final finishing operations.

ADVANTAGES OF THE PLANT

This plant possesses several advantages, some of which can be indicated as follows:

1. The material is first impregnated with a weak color paste that fills the innermost cells, and then with a bath with a higher content of filling agent to concentrate the first paste deposited, which also adds the final coloring.

2. By regulating the strength of the two baths, the cotton cloth can be filled more or less heavily, in accordance with requirements.

3. By means of multiple speed electric motor adopted for the driving of the plant, the yardage treated per minute can be varied in accordance with the nature of the fabrics being padded, the quality of the size present in troughs B and A, the production desired, etc.

4. Through the possibility of heating the lower units of the squeeze rollers G and F, the sizing bath remains all through at the same temperature, even when the cloth is passing between the nip of such rollers. In this way, not only is a useless cooling avoided, but the material is also left with a more uniform content of the sizing bath than would be otherwise the case.

5. If necessary, the material can only be sized in trough B and sized and colored in trough A.

6. Should it be necessary, the material can be colored with a direct color in trough B and topped with a basic color in trough A.

7. In some cases the plant can be employed for coloring and sizing with only one bath, either contained in both troughs B and A or in only one of the same, etc.

(To be continued in an early issue)

The Silk Travelers' Association has arranged an old-fashioned stag outing and field day for its members and their friends, to be held at Colonial Inn, City Island, N. Y., next Saturday, July 28. Busses will leave 2 Park Avenue, New York City, at 10 a. m. There will be a shore dinner and a full program of athletic events to suit everybody.

AMERICAN
DYESTUFF REPORTER

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

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FASTNESS DEMANDS AND FASTNESS EDUCATION

DECIDEDLY thought-provoking are some of the opinions voiced by Raymond Curtis, of the Bradford Dyeing Association, in a communication entitled "Fastness: The Silk Dyer's Problem," published this week in the Proceedings. Both this and the reply from the chairman of the Silk Section of the A. A. T. C. C. Research Committee should be carefully read by all readers interested in the problem of standardizing fastness.

Mr. Curtis discusses the silk dyer's dilemma as one who has evidently pondered the fastness question from both the theoretical and the practical angles. He states, quite truly, that the silk dyer must reconcile claims for fastness with the necessity of satisfying other exacting demands, such as high luster.

Now, this allusion to "demands" in relation to fastness suggests an important line of inquiry for those who are at grips with the fastness problem. It opens up for debate, indeed, a number of questions that, taken together, lead into the very core of fastness standardization. What qualities *are* being demanded and required in fabrics? From whence do these demands come? Do they come from the textile manufacturer, from the merchant or from the consumer? If a controversy were to develop along this line of thought, it would lead us to one very pertinent conclusion, namely, that no greater step forward can be taken in solving the fastness problem than to educate those who are demanding certain qualities in fabrics. It may be the retail merchants or it may be the public or it may be both of these that should be educated on the subject of fastness, but in any case the need for such education becomes more apparent every day.

Those who discuss color fastness in textiles, therefore, should take care that any allusion to "demands" or "requirements" is specifically understood by the audience. Too much depends on these demands to treat them vaguely. If we are to proceed intelligently toward a practical solution of the fastness question, if we are to standardize fastness in textiles, we must be clear about *who* is "demanding" certain kinds or degrees of fastness and who is "requiring" this quality or that in fabrics. We need to know if the demands and requirements are justified, if they are fair or unfair, if they spring from a thorough knowledge of the fastness question or from arrogant ignorance and group selfishness.

If it is the buying public that is demanding faster, more serviceable goods, let us determine what that public really means by faster goods and what other qualities in fabrics that public is willing to sacrifice to get fastness. If it is the public that requires certain qualities in textiles to make them more beautiful and serviceable, let us be sure the public knows that some of those qualities add to the cost of making fabrics. Furthermore, in buying apparel the public must be clear in its own mind as to what kind of fastness it actually needs and what kind it expects to get for the price. It must be clear in its own mind whether or not it expects a fabric to stand ordinary washing or dry-cleaning or extraordinary exposure to color-destroying agents. If the public is not clear on these fundamentals in regard to fastness, it is the duty of the manufacturers and merchants to inform the public. Textiles have been bought and sold for thousands of years; is it not time that any vagueness about their qualities be definitely cleared up?

It should be observed that our inquiry into "demands" has led us to the need for fastness education.

If it is the manufacturers, on the other hand, who are demanding and requiring certain properties in their fabrics, let us ask why they make such demands and to whom they make them. Are they calling for faster dyes or a wider range of fast colors? If so, let our dye manufacturers convince the mills that almost every practical dyestuff need can now be supplied. Are the mills trying to satisfy a certain class or group of merchants or are they trying to satisfy the ultimate consumer, the public? If it is a group of retail or wholesale merchants they are trying to satisfy, the question is, what do those merchants know about fastness? If the merchants' ideas on fastness are vague, then again it is up to the manufacturers to educate the merchants on the subject. It should be made clear to them that in many cases if one kind or degree of fastness is demanded, another kind must be sacrificed or some other quality, such as luster in silk, must be sacrificed.

It is, after all, largely a case of compromising to satisfy the public, which actually uses the merchandise. All groups should understand why a compromise is necessary in dealing with fastness demands, and what compromise must be made. Again, our inquiry into the reasonableness of demands has led to the need for education.

Any solution to the fastness problem is, we stated, chiefly a case of satisfying the public. But it is not entirely that. There are others to be satisfied. The textile

manufacturer must satisfy himself that his fabrics or his dyes are fast to certain processes they must undergo before finishing, such as fulling, scouring and mill washing. The requirements of the laundry and the dry-cleaner must be met if they are fair and justified. In making some of their demands the retail merchants or the public often fail to consider the need for fabrics that are not only dainty and pretty but that will stand repeated dry cleaning or laundering; or they go to the other extreme and make unreasonable fastness requirements because they know nothing about standard laundry practice. Here, also, education of the merchant and the public may be necessary, the responsibility resting upon the dry-cleaners and laundries.

Once more our inquiry into demands for certain qualities in textiles has brought us against the great need for education.

The groups that are intently working to standardize fastness should be concerned not only with the requirements being made by mills, merchants and the public, but also with the demands being refused. It has been the refusals to satisfy certain fastness demands, in fact, that has created the most perplexing problem. Again we may justly ask why some mills have balked at filling reasonable requirements and have insisted upon producing goods of inferior fastness. The practice is excusable only if the degree of fastness is known to the buyer, but when the fastness does not satisfy his requirements what is to be done? And why have many merchants failed to satisfy their public's demand for goods that will stand laundering and cleaning? Is it because some manufacturers still believe the fallacy that fast dyes add markedly to the cost of goods? In that case they should be informed as to the cost of dyes in various fabrics. The Tariff Commission published a valuable report on this subject in its Census of Dyes for 1925 which proved that the cost of the dye in a fabric is a negligible factor. Perhaps the manufacturer's cost of processing may be kept down without sacrificing fastness by a change in the selection of his colors, as Mr. Curtis states.

Once more our cross-examination of demands has brought out the need for education.

The education of textile manufacturers, retail and wholesale merchants, the dry goods trade, and the public on the subject of fabric fastness will advance more rapidly with the establishment of standards of dye fastness, like those being formulated by the A. A. T. C. C. These standards will supply a common language or medium of communication between all interested groups. Before the standards can be completely formulated, however, arduous research is necessary. Before the standards can be recognized and accepted by the textile trade and the public, extensive publicity is necessary. And before either technical research or adequate publicity can be successful, stronger support in the project from the textile and the dyestuff industries is necessary.

FIRST HALF-YEAR'S BUSINESS GENERALLY FAVORABLE

ECONOMIC conditions of the first half of this year have justified neither the wails of the pessimists nor the rosy predictions of the extreme optimists. If assurance could have been given that the production of steel would surpass that of 1927 or 1926, says the National City Bank in its semi-annual review, or that building operations would outstrip those of the corresponding period of last year and that the automobile industry would stage a comeback, the general opinion would have been that a good year was in prospect. These are the outstanding features of the first six months of 1928 and they imply industrial activity.

Despite the good showing in steel, automobiles and construction work, however, there is evidence that the total volume of trade is not quite up to that of the first six months of 1927.

Trade has been affected by unfavorable weather conditions, the spring being decidedly backward. Wholesale and retail trade increased generally in May. Mail-order houses and chain stores showed decided gains over May of last year.

The cotton goods industry has been suffering from too much output, and has been in the chronic condition of not being able to buy new supplies of raw material upon the basis of goods prices. Under pressure to reduce costs the mills have been developing the policy of night operations, which reduces the percentage of the overhead charge, but probably reduces selling prices still more. Rising prices for raw cotton, due to the poor crop prospects, is now aiding the movement of goods, and may relieve the mills which have been accumulating stocks.

The rayon industry is the most active branch of the cloth-making business, and very interesting developments are under way in this field. The natural silk industry also is busy, and at present aided by cheap raw material. Imports of raw silk from Japan have been surpassing all records.

The entire manufacturing and selling business of the American Schaeffer & Budenberg Corporation, including good-will, trade names, trade-marks and patents, has been purchased by Manning, Maxwell & Moore, Inc., makers of steam specialties. The former company manufactured recording tachometers, making permanent records of machine speeds.

In the future the business of the American Schaeffer & Budenberg Corporation will be conducted by the Consolidated Ashcroft Hancock Company, Inc., an operating company owned exclusively by Manning, Maxwell & Moore. It is the intention of the latter concern to pursue a liberal and constructive policy in research and development, it is stated in the announcement, particularly in connection with indicating and recording industrial instruments.

EXTRACTORIALS

Research has failed just in so far as it has been misunderstood. A land flowing with milk and honey was promised by many foolish scientific people who thought that the application of science to textile manufacture only began during the war and that this untilled field contained bars of solid gold just below the surface. The result has naturally been disappointing to the misguided minds of textile manufacturers. . . . Commercially valuable results *have* been obtained, but they have been obtained by the slow and certain method of searching for fundamental truths and not as the result of chance discovery or invention.—*Dr. J. H. Lester, in the Journal of the Textile Institute.*

It is natural that any effort to lay down a general rule for the regulation of the trade between nations would face many difficulties. Politics always outweighs economics in politico-economic programs. This is the reason why the tendency of the industry is to handle its own foreign trade problems.—*Oil, Paint and Drug Reporter.*

A visitor to the German chemical industry is impressed not only by its technical aspects but also by some other characteristics that are worthy of thought. One is the relations existing between the companies and their employees. Labor turnover as we know it in the United States is almost unknown.—*Chemical and Metallurgical Engineering.*

It is recognized that mass production in many of the lines of industry is a necessity from a profit standpoint in the manufacture of staples and where competition is very keen. But in textile lines, where diversification of product, due to the style trend, is so pronounced, the question is entirely different. Diversification of product requires that the manufacturer keep abreast of the times and set a fair price for his product.—*Dr. E. W. France, director of Philadelphia Textile School.*

Many chemicals and related substances are standardized under the laws of the United States and those of the several States. Standards for some few have been fixed by consumers. In all too many instances, however, these standards are not known to manufacturing consumers of the materials to which they apply.—*Oil, Paint and Drug Reporter.*

A lesson that seems to be very hard for many people to learn is that the possession of judgment in some one line does not protect against gullibility in an unrelated field. In the evaluation of a technical matter, training and experience, and not native ability are concerned. To say that a man with legal or business training is not qualified to judge an involved chemical or engineering problem is not a reflection on his power or wisdom, any more than it would be to say that a chemist is not competent to perform a surgical operation or give an opinion on the legality of a bond issue.—*Chemical Bulletin of the A. C. S. (Chicago).*

AN OLD-TIME BLEACHERY

(*Continued from page* 468)

requisite degree of whiteness has been attained, the cloth is removed to the starching room, where, after each piece has been temporarily sewed together, the whole is, by means of a very ingenious machine, at once starched, rolled perfectly smooth and thoroughly dried, ready for making up in separate pieces for the warehouse.

For cloths of a coarser or stronger texture, which are sold or used in the gray state, two rooms are fitted up with machinery for dressing and finishing them; the three uppermost ranges of windows admit light to the stove, which is equal in height to three stores, and extends over the entire building, this spacious room being heated by large steam pipes, intersecting every part of the floor. Currents of air can also be admitted by an excellent arrangement of the window shutters, the whole of which can be opened or shut, either partially or entirely, by a single lever and the ordinary power of one arm.

The stove is divided into three compartments; across the top are placed a number of horizontal rails, about one foot apart from each other, from which the cloth to be dried is suspended in long folds by means of a patent machine, worked by two boys, who can fill the stove in an incredibly short time.

The same method and dispatch are displayed in removing the cloth, which is so hung as to allow of all the pieces in the stove being drawn into a separate room by one man, who can also at the same moment fold it in equal portions, ready for packing, while, by a machine now common in large manufacturing establishments, the goods can, in a few seconds, be raised from the cellar to the top of the building, or lowered with equal celerity.

An Old Statute

The admirable economy of space, material and labor which distinguishes the management of the Adelphi Bleach Works, strikingly illustrates the rapid advances of our manufacturing skill. In the preamble of an act passed in 1542, for abolishing the privilege of sanctury in Manchester, it is declared, among other reasons for the statute, that "the linen yarn must lie without, as well in the night as in the day, continually for the space of half a year, to whiten before it can be made into cloth, and the woolen cloths must hang upon the tenters to be dried before it can be dressed," by which great facilities were afforded to "divers light and evil disposed persons

to steal yarn from the crofts, and cloth from the tenters, to the great impoverishment of the owners and to the destruction of the confidence formerly reposed in them by their creditors, which, if not prevented, will lead to the decay and desolation of the town."

It is no uncommon occurrence now for goods to be sent down from the manufactory in their gray state in the afternoon of one day, and to be offered in the market on the following morning bleached, dressed, starched and finished; and thus the bleacher fully sustains the general railway expedition that begins to characterize every department of our national industry. When results like these are contemplated as a portion of the triumphs of human intelligence over mere inert matter, it is surely not too sanguine to anticipate the period when, instead of glutted markets, depreciated stocks and unemployed artisans, consequent on the abridgment of physical labor by the application of machinery, the humblest classes of society will be so far relieved from the necessity of ceaseless toil as to possess at least a few hours of each day for domestic and social enjoyment, and the cultivation of their immortal minds for the loftier joys and purer pleasures of that more glorious state of being, held out by the revelations of truth as the object of our common faith and hope, and where "boundless charity divine" shall never die.

ZAPON COMPANY ACQUIRES DURATEX CORPORATION

Richards & Co., Inc., of Stamford, Conn., owners of the Zapon Company, has acquired the Duratex Corporation, of Newark, N. J. Manufacturing operations of the Duratex Corporation, which has specialized for many years in the manufacture of pyroxylin double-coated and rubber-coated roofing materials for the automobile trade, will be continued under the same management and personnel.

Many of the original members of Richards & Co., Inc., including its president, are active in its management. The company is one of the few which manufacture the basic raw materials entering into the manufacture of pyroxylin leather cloth, namely, nitro cellulose. In addition to nitro cellulose, Richards & Co., Inc., manufactures the nitric acid used in its production, refines and converts all the solvents used, and dyes all the gray goods.

NATIONAL ADDS AN ACID BLACK

An Acid Black, stated to be exceptionally well suited for silk dyeing, has been developed and placed on the market by National Aniline & Chemical Company under the name of National Buffalo Black GRF Conc. It is best dyed with Glauber salt and sulphuric, yielding deep shades described as free from crocking and of better penetration than those resulting from shaded Acid Blue Blacks.

Buffalo Black GRF Conc. is further described as a true black not requiring the use of orange or other shading colors for general purposes, and as possessing good fastness to light. It stains cotton or rayon effects only slightly, which, it is said, will permit its use for the production of styles for which ordinary Acid Blue Black combinations are not so well adapted. It is also suitable for printing both on wool and on silk.

PYREX REELS A FEATURE OF SKEIN DYEING MACHINERY

Practical trials have been made for several years with Pyrex reels on various types of skein dyeing equipment, and it is now declared that these reels have proved themselves to be a definite step forward in skein dyeing. The new reel contains six ribs designed to engage the yarn at short intervals, preventing slippage of the skein on the reel and consequent shifting of the tie-bands that causes difficulty in winding. The surface or "finish" of the reel is different from either porcelain or glass, and it is claimed that this feature has tended to overcome certain faults of other types of reel.

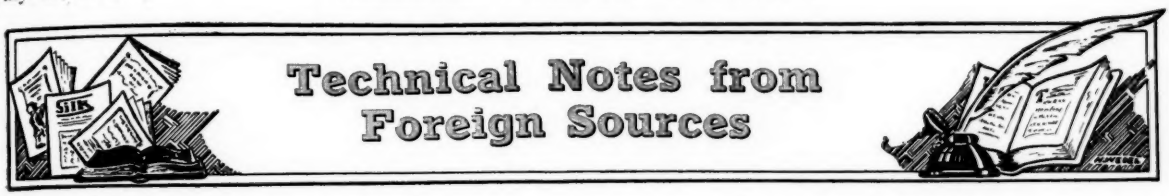
The extensive use of Pyrex for cooking material has been a convincing test of its ability to withstand continued exposure to extreme heat and sudden changes in temperature. Trouble from surface cracks, it is said, have been unknown. The reel is a product of the glassblower's art, the molten glass being blown with enormous air pressure against an outside mould that insures uniformity of the reels and perfection of design and construction.

The introduction of the Pryex reel to dyeing equipment was somewhat in the nature of an experiment, but preliminary trials and tests made by one large manufacturer of skein dyeing equipment are said to have been so conclusive as to warrant the adoption of the reel as standard equipment for that firm's skein dyeing machinery.

Albert H. Grimshaw, Associate Professor of Dyeing at the Textile School of North Carolina State College, is devoting six weeks to work for an advanced degree at Columbia University, New York.

Professor Grimshaw has been a frequent contributor to the textile press, and has recently written a series of articles on the starches used in North Carolina mills. These articles were based upon an exhaustive series of tests, conducted by him and the textile students, upon starches furnished the school by more than fifty mills.

Clark H. Foster, general manager of Tolhurst Machine Works, of Troy, N. Y., for more than twenty years, resigned his position this month. He was succeeded by T. A. Bryson, who for fifteen years has been chief engineer of the plant, in which capacity he designed the various types of centrifugal machines for industrial use for which Tolhurst has become so well known.



Developed Dyestuffs—Azoic and Other Insoluble Colors

A. E. Everest and J. A. Wallwork; J. Soc. Dyers and Col., 101, 44 (1928).—A paper read before a joint session of the Manchester Section of the society, with the Manchester Section of the Oil and Colour Chemists' Association.

The paper as a whole is a review in some detail of the history of developed colors. It is interesting to note that the process was first introduced by the English firm of Read, Holliday, in 1880, and that its elaboration later passed into the hands of German workers, but that in recent years British chemists have begun to regain the field to a certain extent. Holliday's first patent (English Patent 2757/80) employed beta-naphthol for padding, and the simpler amines for developing. The same results were sought by Bayer by the mere converse process, padding with the diazotized amine and developing with the beta-naphthol bath; and also by the firm of Meister, Lucius and Bruening, through impregnation of the fabric with soluble bisulphite compounds of insoluble azo compounds, and by decomposition of these compounds liberating the insoluble azo compound in and on the fiber. (This principle still persists as a valuable one in some cases of other than azo compounds.) The latter firm, in 1889, patented a modification (hardly such, however) which employed mixtures of various bases and nitrite, which on solution in dilute hydrochloric acid furnished conveniently a diazo solution, through which the fabric, previously padded with beta-naphthol, was passed. The oiling of the fabric received much attention at about the same time (Holliday, English Patent 20,064/89). Also, at about the same time, Meister, Lucius and Bruening secured patents covering the discharging of Indigo, with the production of Para Red and similar azo colors on the discharge, and introducing the use of dianisidine with copper salts on a beta-naphthol ground for fast blues, also the use of mixtures of dianisidine and other bases to produce blacks.

With beta-naphthol alone as padding agent, a fair range of colors can be produced by employing various amines as developers. The range of colors possible is not complete, however; to extend the range, various pyrazolones for yellows, and the arylides of 2-hydroxy-3-naphthoic acid for certain other colors, have been gradually introduced into practice. Most of the researches carried on have probably been directed toward the synthesis, in practicable quantity and commercially-profitable cheapness, of the amines which have been proposed, and, to some extent at least, at some time or other used. Nitrated bases have been largely investigated (of the various nitro-anilines and dinitro-anilines, the nitro-toluidines, nitro-anisidines, and nitro-phenetidines), and the similar chlorinated bases. It has become evident that "the mere introduction of a group or atom into the aromatic nucleus is, however, of secondary importance as compared with the position of the group." It appears that substitution in the ortho position to the amino group has the most advantageous effect, the para position coming next in importance, and the meta position last; and that in case of twofold substitution the advantage lies with those amines in which one group stands in the ortho, and the other group in the para, position to the amino group. The ground has been thoroughly worked; thus, two German firms propose as suitable and advantageous amines six chlor-nitro-anilines, viz., 2-chlor-4-nitro-, 3-chlor-4-nitro, 4-chlor-2-nitro-, 5-chlor-2-nitro-, 6-chlor-3-nitro-, and 4-chlor-3-nitro-anilines, none of which are any too easy to prepare satisfactorily. Such work has, of course, extended to the chlor-nitro-derivatives of the three toluidines and to negatively-substituted phenol-esters and carboxylic esters. Some extension of study in the use of the naphthylamines and of amines of the anthraquinone series has also been accomplished. From all of these amino compounds, directed toward a comparatively few padding compounds, vast range of azo color, differing in color, shade, fastness and insolubility (since insolubility is usually a chief requisite, this phrase may perhaps be pardoned) is now available.

Possibly the introduction of arylides of the 2-hydroxy-3-naphthoic acid series as second components has marked the greatest advance, after the first discovery itself of the process of developed dyeing. Those arylides are usually referred to as the "Naphthol AS" series. The great advantage which they possess over beta-naphthol lies in the fact that they show direct affinity for vegetable fibers, so that the padded goods do not need to be dried before development. The Naphthol AS series has been strongly pushed of late years, and has awakened much enthusiasm; but it has not displaced, and probably will not, the older staples from beta-naphthol, because of the greater expense of the members of the series, and also because many of the simpler dyestuffs or pigments from beta-naphthol are quite satisfactory for many purposes.

The troublesome phenomenon known as blinding is stated to have its counterpart in the preparation of pigments. "It can usually be assumed that if there is any tendency (in the case of a given dyestuff) to blinding of textiles, the pigment maker will have trouble in obtaining the finely-divided and flocculent material, with good covering power, which the user requires." Blinding seems to be a consequence of actual crystallization of the dyestuff, a property of the latter and not of either of its components. The phenomenon may be prevented if there

is present in the fiber some substance known to prevent ready crystallization of the dyestuff. By way of parallel, synthetic Indigo will usually blind unless some sort of colloid is present to prevent crystallization, while natural Indigo contains some substance which has this effect. In this connection it may be pointed out that a pigment-substance may be of excellent fastness, shade, etc., but useless, because of poor covering power. It appears that under suitable conditions certain pigments form appreciable crystal aggregates, whereby the covering power is greatly reduced. This is about of the same nature as the difficulty from blinding on fabrics. It is much more true of Naphthol AS couplings than of those from beta-naphthol. It is true also of vat dyestuffs.

Azo dyestuffs developed on wool and on silk have proved difficult of achievement. The alkali necessary in the padding injures the fiber. Goldorvsky in 1897 avoided this difficulty by dyeing the wool with a solution of para-nitro-aniline hydrochloride, diazotizing on the fiber, and developing in an alkaline solution of beta-naphthol, followed by washing; also by working the material in a solution of the nitro-aniline salt, and then proceeding as before. The Badische Company claimed to have avoided the difficulty by impregnating the wool with the coupling components in alkaline solution containing much common salt. The I. G. Farbenindustrie A. G. proposes the dyeing of silk with the Naphthol AS series, using Protectol to shield the fiber from attack by alkali.

The authors of the paper have been working for some time upon this same subject (wool and silk developed dyeings), but from a different angle. They have discovered that under proper conditions beta-naphthol, as well as the members of the Naphthol AS series, possess an affinity for animal fibers. Thus, beta-naphthol can be taken up, under suitable conditions, in a soap solution, either with caustic soda, carbonate, or no alkali at all, to produce a solution or suspension, which can be used with excellent results on wool or silk. No caustic is necessary; soda ash or ammonia give excellent results, and even if no alkali at all is present, dyeing can take place, especially in the case of silk. The Naphthol AS series can be used similarly for wool, without caustic being needed; and for silk no alkali at all is required, a decided affinity being evident between naphthol and fiber, so that dyeings can be carried out at a temperature which would mean total destruction of the fiber if alkali were present. Apparently beta-naphthol has a better affinity for animal fibers than has Naphthol AS, etc.; it is cheaper, and the colors produced are more brilliant and productive. The cost is low, and the results excellent. Printing can be carried out on wool and silk fabric prepared by the new process, and in some cases vat dyestuffs can be used in conjunction with the azo colors.

It is reported that the Salmon Falls Manufacturing Company, Salmon Falls, N. H., has closed negotiations with the Public Service Company of New Hampshire for the sale of its power plant and water rights.

NEW VAT OLIVE AND OTHER DU PONT COLORS

The Dyestuffs Department of E. I. du Pont de Nemours & Co. has recently developed and placed on the market a new vat Olive, an addition to the Pontamine series and a new Leucosol dyestuff. The vat color, Ponsol Olive AR Double Paste is chiefly for use in combinations with Ponsol Yellow AR and Brown AR Double Pastes for producing khakis and olive drabs. The shades are said to be practically unaffected by Government specification tests. Ponsol Olize AR Double Paste is described as possessing excellent fastness to light and washing, as well as good resistance to all destructive agents with which goods dyed to stand long wear and exposure come in contact.

The new Pontamine color, Pontamine Fast Blue 8GL, can be used on all types of cotton goods both as a self shade and in combination, and, according to the announcement, can be dyed on all types of machines. Described as a very greenish blue of very good fastness to light, this color, it is claimed, becomes only slightly greener and duller under artificial light. Silk and wool in union materials when speck dyed are left unstained; when union dyed the animal fibers are much weaker than the cotton.

The series of Du Pont colors recently developed for the printing trade, known as the Leucosols, have been increased by the addition of Leucosol Dark Blue BR Paste. This is a vat dyestuff yielding bright reddish blues described as being of excellent fastness to light, washing, commercial laundering, etc., and of good fastness to chlorine.

Leucosol Dark Blue BR Paste, it is stated, produces printing pastes of very desirable working qualities, which can be printed with little or no glycerine, according to conditions of aging in the mill.

The rate for "Position Wanted" advertisements in this column is 2 cents a word—with a minimum of 50 cents per insertion. For all other types of advertisements—i. e., help wanted, machinery or supplies for sale—the rate is $5.00 per column inch or less per insertion.

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Dyestuff salesman wanted by old-established concern for New England territory. Only a live-wire man who is acquainted with the Rhode Island, Northern Connecticut and Southern Massachusetts territory should apply Address Box 470, American Dyestuff Reporter.

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